European Journal of Internal Medicine 21 (2010) 21–24

Contents lists available at ScienceDirect

European Journal of Internal Medicine

journal homepage: www.elsevier.com/locate/ejim

Original article

Esophageal motility and 24-h pH profiles of patients with heterotopic gastric mucosa in the cervical esophagus

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ARTICLE INFO

Article history:
Received 4 August 2009
Received in revised form 19 October 2009
Accepted 22 October 2009
Available online 27 November 2009

Keywords:
Inlet patch
Esophageal motility
pH monitorisation

ABSTRACT

Background: Heterotopic gastric mucosa occurs as a flat island of red mucosa in the proximal third of the esophagus where it gives rise to the cervical inlet patch. The aims of this study were to investigate the esophageal motility pattern and 24-h pH profiles of patients with cervical inlet patch.
Methods: Thirty patients (16 women, mean age: 44.9 years, range: 23–72) diagnosed as having heterotopic gastric mucosa in the cervical esophagus with upper gastrointestinal symptoms had undergone esophageal motility testing and 24-h pH monitorisation with a double-channel pH probe.
Results: Manometric investigation was abnormal in 7 patients (non-specific esophageal motor disorder in 4 patients, esophageal hypomotility in 1 patient, and hypotensive LES in 2 patients). Pathological acid reflux (pH<4) was found in 9 (30%) of 30 heterotopic gastric mucosa patients during pH monitorisation from the distal probe. Pathological acid reflux in the proximal esophagus (percentage of total time of pH<4) was seen in four of these nine patients. Only four of the 30 patients (13.3%) presented with "acid independent episodes" during the 24-h esophageal pH monitorisation.
Conclusion: Manometric investigation and 24-h pH monitorisation revealed that some of the patients with HGM have signs of esophageal motor dysfunction and "acid independent episodes" from the patches. These abnormalities may be responsible for some of the symptoms of HGM patients.

1. Introduction

Heterotopic gastric mucosa (HGM) in the cervical esophagus is a macroscopically yellowish pink in color lesion of congenital origin characterized by the presence of gastric epithelium in the upper esophagus. It has been defined in various areas of the gastrointestinal system, such as esophagus, tongue, gall bladder and rectum [1–4]. The reported prevalence of HGM ranges from 1.1% to 10% in upper gastrointestinal endoscopy [1,5–10]. The prevalence may be underestimated since, in daily practice, HGMs are often undetected by many endoscopists. Although mostly asymptomatic, it can also present itself with esophageal and laryngopharyngeal symptoms such as dysphagia, heartburn, retrosternal pain, chronic cough and dyspnoea. HGMs are noteworthy that the literature contains reports of local complications associated with HGM, including cases of upper esophageal rings, stenosis, esophagotracheal fistulas, ulceration, hemorrhages, perforations, and even adenocarcinoma [11–21].

It has been suggested that the capacity of HGMs to secrete acid is responsible for both the clinical symptoms and the occasional local complications associated with these lesions. Some studies were performed after the artificial stimulation of acid secretion with gastrin analog substances [1,5,22,23]. Recently, acid secretion of HGM patients had been shown with esophageal 24-h pH-metry [24,25]. Most published studies of cervical inlet patch have been limited to investigating its histology, prevalence or detailing rare complications. However esophageal motor function and esophageal pH measurement have never been investigated at the same time, therefore the objectives of the present prospective study were to evaluate 24-h esophageal pH monitorisation and esophageal motility in HGM patients.

2. Patients and methods

Thirty patients diagnosed as having HGM were enrolled in the study. These patients were selected from patients ($n=1947$, 1.54%) who had undergone routine upper gastrointestinal endoscopy due to various upper gastrointestinal symptoms. All patients were carefully questioned regarding symptoms involving laryngopharyngeal and esophageal regions. Symptoms included heartburn, sore throat, globus sensation, dysphagia, feeling of cleaning throat, chronic cough, hoarseness and halitosis. Clinical characteristics, manometric and pH profiles of patients were evaluated.

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0953-6205/$ – see front matter
doi:10.1016/j.ejim.2009.10.009

2.1. Endoscopic study

Upper GI endoscopy was performed with a videoendoscope (Fujinon EG-410 HR, Tokyo, Japan). During the withdrawal of the endoscope, the endoscopist carefully examined the upper third of the esophagus and upper esophageal sphincter area for HGMs. The definition of inlet patch was made as described elsewhere [8]. In brief, inlet patch was diagnosed as patches covered with salmon-red mucosa that is discriminated from the surrounding greyish-pearly colored esophageal mucosa by their well-defined margins. The size of the patch was determined by comparing with the length of the metallic tip of the biopsy forceps (5 mm). The patches were classified into three groups: 1) small-sized patches (those smaller than the biopsy forceps length size: <5 mm); 2) medium-sized patches (those in which the largest axis was between two and three times the length of the biopsy forceps size: 6–19 mm); and 3) large-sized patches (those bigger than four times the length of the biopsy forceps size >20 mm).

2.2. Esophageal motility

Esophageal motility studies were performed with pull-through technique that runs microperfusion system by using a single catheter containing 8 pressure transducers spaced at 5-cm intervals and attached to an online computer (MMS, Medical Measurement Systems, The Netherlands). Patients came to the laboratory after at least 8 h of fasting. The 8-channel catheter was lubricated and passed nasally and advanced into the stomach. A slow station pull-through was performed at 1-cm increments. Once the lower esophageal sphincter (LES) was profiled, the distal pressure transducer which included four lumens was placed in the high-pressure zone of the LES, so that the proximal pressure transducers were located at 5, 10, 15 and 20 cm above the LES. A series of 10 wet swallows (with 5-ml water bolus) were given at 20–30 s intervals. Average lower esophageal sphincter relaxation pressure (reference 6–25 mm Hg), percentage of wet swallowing over peristaltic waves (reference >80%) and average esophagus corpus amplitude (reference 30–160 mm Hg) were determined. Each contraction was recorded and then analyzed by a computerized software system (MMS) for amplitude, contraction and velocity. Lower esophageal sphincter relaxation and residual pressures were also recorded.

2.3. 24-h esophageal pH study

Localization of LES was defined by manometric observation, and pH measurement was made by using double sensor antimony catheter which was placed 5 cm above the LES. Second sensor was placed 20 cm above the lower esophageal sphincter. Patients were instructed to abstain from acidic beverages. During the 24-h period they spent with the pH-metry, they completed a diary in which they registered the type of meal and/or drink consumed. Acid secretion from HGM was defined as any episode of pH<4 recorded by the proximal sensor that was not preceded by an episode of pH<4 recorded by the distal sensor. Such episodes will be termed as “acid independent episodes”. The percentage of total time of pH<4 recorded by the proximal sensor was used to calculate inlet patch acid secretion.

The following pH monitoring parameters were used with corresponding reference values for quantification of acid reflux: total pH<4 reflux period (<4.2 total %), while standing (<6.3 total %), while supine (<1.2 total %), number of reflux episodes (<50), longest episode (<9 min), number of longest reflux periods >5 min (<3), and the Johnson–DeMeester score (>14.7). The evaluation of 24-h pH-metry and motility parameters were analyzed by using MMS software program.

The present study was approved by the Institutional Review Board of Ankara University Medical School and all patients signed informed consent before entering the study.

2.4. Statistical analysis

Data were analyzed with the Statistical Package for Social Sciences (SPSS; version 11.0; SPSS Inc. Chicago, IL) for Windows software. Mann Whitney *U* test and Kruskal Wallis test were used for group comparisons. For categorical variables Chi-Square test was used. Mean ± SD was given for continuous measurements. A p value <0.05 was considered as significant.

3. Results

Thirty patients (16 women) were enrolled into the study. The mean age of the patients was 44.93 ± 12.75 (range 23–72) years. Thirteen patients had small-sized inlet patches, 14 patients had medium-sized inlet patches and 3 patients had large-sized inlet patches. Twenty-nine patients presented with single inlet patch. Erosive esophagitis was found in 11 HGMs patients according to the Los Angeles classification (9 grade A, 2 grade B).

There was heartburn in 18 (60%) of patients. Dysphagia in 9 (30%), globus sensation in 12 (40%), chronic cough in 8 (26%), hoarseness in 3 (10%), halitosis in 12 (40%), frequent cleaning of throat in 16 (53%), sore throat in 6 (20%) and morning hoarseness in 10 (33%) were found. Dysphagia, sore throat, and morning hoarseness were significantly higher in patients with heartburn compared to patients without heartburn (44.7% vs. 8.3% $p = 0.04$; 16.7% vs. 0 $p = 0.031$; 50% vs. 8.3% $p = 0.021$ respectively) (Table 1).

As for manometric findings, median LES pressure (mm Hg), LES relaxation (%), esophageal body contraction amplitude (mm Hg), and peak velocity (s) were 19.83 ± 14.62 mm Hg, 92.10 ± 10.06%, 86.33 ± 24.57 mm Hg, and 2.82 ± 1.79 s respectively. There was no significant difference between LES pressure (mm Hg) (20.83 ± 16.17 vs. 18.33 ± 12.46, $p = 0.391$), contraction amplitude (mm Hg) (62.94 ± 22.84 vs. 70.16 ± 30.56, $p = 0.761$) and peak velocity (s) (2.70 ± 2.14 vs. 3.00 ± 1.14, $p = 0.261$) in patients with reflux symptoms compared to patients without reflux symptoms (Table 2). Manometric investigation was abnormal in 7 patients (non-specific esophageal motor disorder in 4 patients, esophageal hypomotility in 1 patient, and hypotensive LES in 2 patients). Four cases suffering from reflux symptoms in which endoscopy showed grade B esophagitis in 1, and grade A esophagitis in 3 cases. Results of patients with abnormal motility were summarized in Table 3.

Pathological acid reflux (pH<4) was found in 9 (30%) of 30 HGMs patients during pH monitorisation from the distal probe. Pathological acid reflux in the proximal esophagus (percentage of total time of pH<4) was determined in four of these nine patients. pH<4 of total reflux duration, number of reflux periods <5 min, longest reflux duration, and Johnson–DeMeester score were significantly different in patients who had esophageal motility disorder compared to patients

Table 1
Comparison of symptoms of patients with heartburn and without heartburn.

	Whole patients ($n = 30$)	Heartburn (+) ($n = 18$)	Heartburn (−) ($n = 12$)	p value
Dysphagia	9 (30%)	8 (44.4%)	1 (8.3%)	0.040
Globus sensation	12 (40%)	9 (50%)	3 (25%)	0.162
Chronic cough	8 (26%)	6 (33.3%)	2 (16.7%)	0.282
Hoarseness	3 (10%)	3 (16.7%)	0 (0%)	0.201
Halitosis	12 (40%)	8 (44.4%)	4 (33.3%)	0.412
Feeling of cleaning throat	16 (53%)	12 (66.7%)	4 (33.3%)	0.078
Sore throat	6 (20%)	6 (33.3%)	0 (0%)	0.031
Morning hoarseness	10 (33%)	9 (50%)	1 (8.3%)	0.021

Table 2
Esophageal manometric findings in patients with HGM and comparison of esophageal motility parameters in patients with and without heartburn.

	Whole group ($n=30$)	Heartburn (+) $n=18$	Heartburn (−) $n=12$	p
Mean age	44.93 ± 12.75	44.94 ± 11.12	44.91 ± 15.42	0.995
Sex (male/female)	14/16	6/12	8/4	0.078
Mean diameter of HGM (mm)	10.00 ± 5.68	10.16 ± 6.25	9.70 ± 4.80	0.840
Manometric results				
• LES pressure (mm Hg)	19.83 ± 14.62	20.83 ± 16.17	18.33 ± 12.46	0.391
• LES relaxation (%)	92.10 ± 10.06	94.72 ± 4.66	88.16 ± 14.33	0.001
• Esophageal body contraction amplitude (mm Hg)	86.33 ± 24.57	62.94 ± 22.84	70.16 ± 30.56	0.761
• Peak velocity (s)	2.82 ± 1.79	2.70 ± 2.14	3.00 ± 1.14	0.261

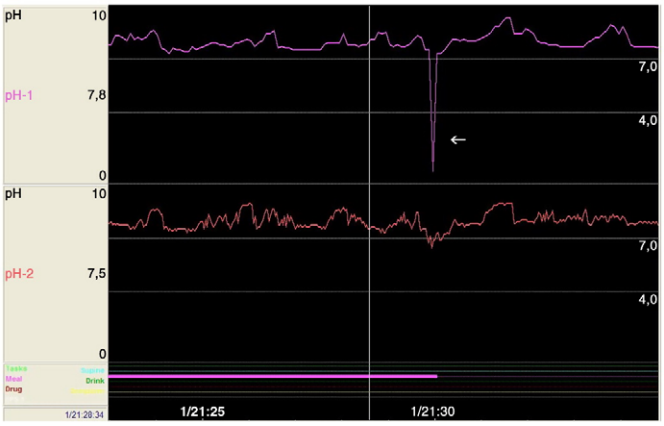

Fig. 1. 24-h pH monitoring of the proximal and distal esophagus. Recording from the proximal esophagus shows a drop in pH consistent with "acid independent episode" (arrow).

who exhibited normal motility pattern. (Table 3). Four of the 30 patients (13.3%) presented with "acid independent episodes" during the 24-h esophageal pH monitorisation. Acid secretion from HGM was defined as any episode of pH<4 recorded by the proximal sensor that was not preceded by an episode of pH<4 recorded by the distal sensor (Fig. 1). Such episodes termed as "acid independent episodes"[25]. Episodes of acid secretion from HGMs occurred in both the upright and supine positions. Two patients had medium-sized patches, and the remaining 2 patients had small-sized patches. The 4 patients with acid secretion from HGMs had the symptoms of dysphagia, globus sensation, and heartburn.

4. Discussion

The capacity of HGMs lesions to secrete acid has been previously shown by several investigators. Jabbari et al. measured pH from the stomach towards the esophagus after administering intravenous pentagastrin in five patients. They found decreased pH in the HGM area in two patients with HGMs of considerable size [5]. In another study, Hamilton et al. applied Congo red solution to the inlet patches of four patients after stimulation with pentagastrin. The black color of these HGMs demonstrated the existence of a pH<4 in these lesions [22]. Nakajima et al., using a sensor attached to the endoscope, measured pH in five patients with HGMs after infusion with tetragastrin. Three of the five patients presented decreased pH at the site of the lesions. Acid secretion was later confirmed using Congo red solution [23]. However, all these studies were performed with very few patients and using low sensitivity techniques. Furthermore, acid secretion was induced by gastrin analog substances.

Galan et al. were the first to use a 24-h esophageal pH-metry to study acid secretion from these lesions. They demonstrated the acid-secreting capacity of HGMs without previous stimulation. In addition, they were the first to show a direct relationship between acid secretion of HGM and their patients' symptoms, since symptoms disappeared on start of proton pump inhibitors, and control pH-metry during treatment confirmed the cessation of acid secretion [24].

Baudet et al. performed double-channel pH-metry in 20 HGMs patients [25]. In 24-h double-channel pH monitorisation, 5 of the 20 patients (25%) presented with acid independent episodes, more than 10% of the total time with pH<4 on the proximal sensor. In 4 of these 5 patients, a total time of pH<4 on the proximal sensor was found greater than that recorded by the distal sensor. Multiple HGMs (4 patients had 2 inlet patches and 1 patient had 3 inlet patches) and greater size (the patients had large-sized patches) were found in these patients. These patients had upper esophageal symptoms: 3 had upper dysphagia, 1 had globus, and 1 had a burning sensation in the throat. They found acid independent episodes of pH<4 on the proximal sensor in another 6 patients. However, the total time with pH<4 did not exceed 1.1%, so these patients were not considered as having acid independent episodes. These patients had small- or middle-sized patches. They concluded that, medium and small-sized inlet patches are able to secrete acid, but in quantities that are undetectable using ambulatory pH-metry. Perhaps stimulation with gastrin analog substances could be used to demonstrate acid secretion in a larger number of patients with small patches [25].

In our study, four of the 30 patients (13.3%) presented with acid independent episodes of pH<4 on the proximal sensor during the 24-h esophageal pH-metry. Episodes of acid secretion from HGMs occurred in both the upright and supine positions. The total time with pH<4 did not exceed 1.1% in these patients. 2 patients had medium-sized patches, and the remaining 2 patients had small-sized patches. We did not observe acid independent episodes of pH<4 on the proximal sensor in large-sized patches patients. We found pathological acid reflux (pH<4) during the measurement of distal sensor in nine (30%) of 30 HGMs patients. Pathological acid reflux in proximal esophagus (total time of pH<1%) was determined in four of these nine patients.

Table 3
Comparison of symptoms of patients with esophageal motility disorder and without esophageal motility disorder.

	Abnormal esophageal motility ($n=7$)	Normal esophageal motility ($n=23$)	p
Mean age	47.57 ± 9.60	44.13 ± 13.65	0.541
Sex (male/female)	6/12	8/4	0.078
Mean diameter of HGM (mm)	9.57 ± 3.10	10.14 ± 6.38	0.823
Erosive esophagitis	3 (42.9%)	8 (34.8%)	0.515
Symptoms			
• Heartburn	4 (57.1%)	14 (60.9%)	0.597
• Dysphagia	0	9 (39.1%)	0.057
• Globus	0	12 (52.2%)	0.016
• Chronic cough	2 (28.6%)	6 (21.6%)	0.623
• Hoarseness	0	3 (13%)	0.436
• Halitosis	2 (28.6%)	6 (43.3%)	0.403
• Frequent cleaning of throat	3 (42.9%)	13 (56.5%)	0.419
• Sore throat	2 (28.6%)	4 (17.4%)	0.433
• Morning hoarseness	1 (14.3%)	9 (39.1%)	0.228

Abnormal esophageal motility was found in 7 HGM patients (non-specific esophageal motor disorder in 4, esophageal hypomotility in 1, and LES hypotension in 2 patients). Four cases were suffering from reflux symptoms and endoscopic examination revealed grade B esophagitis in 1, and grade A esophagitis in 3 cases. Upper endoscopic examination was normal in 3 other patients. Pathological acid reflux (pH<4) was determined in four of these 7 patients. However, any of the patients with acid independent episodes of pH<4 on the proximal sensor did not exhibit abnormal esophageal motility pattern. Those four patients who exhibited acid independent episodes in the proximal sensor benefited well from proton pump inhibitors. Baudet et al. also did not find esophageal dysmotility in their patients with acid independent episodes pH<4 at the proximal sensor [25].

Some investigators have identified HGMs as the cause of upper esophageal symptoms [15–22] while others have found no association between symptoms and the presence or absence of these lesions in their patients [5–7]. In this study, reflux was dominant in HGMs patients. However, symptoms such as globus sensation, cough, hoarseness, halitosis, frequent cleaning of throat, and morning hoarseness were found in a quarter of patients. There was no association between inlet patch size and esophageal or extra-esophageal symptoms. Baudet et al. had reported the association between the largest inlet patches with dysphagia. They explained the pathophysiological mechanism whereby clinical manifestations or local complications from HGMs result from their capacity to produce and secrete acid [25]. In our study, dysphagia, sore throat, and morning hoarseness symptoms were significantly higher in heartburn positive HGM patients.

In conclusion, this study showed "acid independent episodes" from inlet patches. Manometric investigation and 24-h pH monitorisation revealed that some of the patients with HGM have signs of esophageal motor dysfunction and "acid independent episodes" from the patches. These abnormalities may be responsible for some of the symptoms of HGM patients. Our data showed that inlet patches have the capability of spontaneous secretion of clinically relevant amounts of acid irrespective of patch size. In patients presenting with laryngopharyngeal symptoms such as globus sensation and sore throat, a thorough investigation of upper esophagus should be performed by means of endoscopic examination in order to rule out inlet patch and some of these inlet patch patients may benefit from acid inhibiting therapy.

5. Learning points

- Although patients with heterotopic gastric mucosa of the cervical esophagus are mostly asymptomatic, they can also present themselves with esophageal and laryngopharyngeal symptoms such as globus sensation, heartburn, dysphagia, feeling of frequent cleaning of throat, and chronic cough.
- Patients presenting with laryngopharyngeal symptoms such as globus sensation and sore throat, should be sought for the presence of heterotopic gastric mucosa of the cervical esophagus.
- Some of the patients with heterotopic gastric mucosa of the cervical esophagus have signs of esophageal motor dysfunction and "acid independent episodes" from these patches and these patients may benefit from proton pump inhibitors.

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