World Journal of Gastroenterology

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DOI: 10.3748/wjg.v22.i18.4585

World J Gastroenterol 2016 May 14; 22(18): 4585-4593
ISSN 1007-9327 (print) ISSN 2219-2840 (online)

ORIGINAL ARTICLE

Observational Study

Changes in patients' symptoms and gastric emptying after *Helicobacter pylori* treatment

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Author contributions: Zhang CL and Geng CH contributed equally to this work; Zhang CL, Geng CH and Yang ZW designed the research; Zhang CL, Geng CH, Li YL, Tong LQ, Gao P and Gao YQ performed the research; Yang ZW, Tong LQ, Gao P and Gao YQ contributed new reagents/analytic tools; Zhang CL and Geng CH analyzed the data; Zhang CL and Geng CH wrote the paper.

Institutional review board statement: The study was reviewed and approved by the Institutional Review Board of Daqing oilfield general hospital.

Informed consent statement: All study participants, or their legal guardian, provided informed written consent prior to study enrollment.

Conflict-of-interest statement: We declare that no conflict of interests in our study is going to disclose.

Data sharing statement: No additional data are available.

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Received: January 24, 2016
Peer-review started: January 25, 2016
First decision: February 18, 2016
Revised: February 29, 2016
Accepted: March 18, 2016
Article in press: March 18, 2016
Published online: May 14, 2016

Abstract

AIM: To investigate the changes in clinical symptoms and gastric emptying and their association in functional dyspepsia (FD) patients.

METHODS: Seventy FD patients were enrolled and divided into 2 groups *Helicobacter pylori* (*H. pylori*)-negative group (28 patients), and *H. pylori*-positive group (42 patients). Patients in the *H. pylori*-positive group were further randomly divided into groups: *H. pylori*-treatment group (21 patients) and conventional treatment group (21 patients). Seventy two healthy subjects were selected as the control group. The proximal and distal stomach area was measured by ultrasound immediately after patients took the test meal, and at 20, 40, 60 and 90 min; then, gastric half-emptying time was calculated. The incidence of symptoms and gastric half-emptying time between the FD and control groups were compared. The *H. pylori*-negative and conventional treatment groups were given

conventional treatment: domperidone 0.6 mg/(kg/d) for 1 mo. The *H. pylori*-treatment group was given *H. pylori* eradication treatment + conventional treatment: lansoprazole 30 mg once daily, clarithromycin 0.5 g twice daily and amoxicillin 1.0 g twice daily for 1 wk, then domperidone 0.6 mg/(kg/d) for 1 mo. The incidence of symptoms and gastric emptying were compared between the FD and control groups. The relationship between dyspeptic symptoms and gastric half-emptying time in the FD and control groups were analyzed. Then total symptom scores before and after treatment and gastric half-emptying time were compared among the 3 groups.

RESULTS: The incidence of abdominal pain, epigastric burning sensation, abdominal distension, nausea, belching, and early satiety symptoms in the FD group were significantly higher than in the control group (50.0% *vs* 20.8%; 37.1% *vs* 12.5%; 78.6% *vs* 44.4%; 45.7% *vs* 22.2%; 52.9% *vs* 15.3%; 57.1% *vs* 19.4%; all $P < 0.05$). The gastric half-emptying times of the proximal end, distal end, and the whole stomach in the FD group were slower than in the control group (93.7 ± 26.2 *vs* 72.0 ± 14.3; 102.2 ± 26.4 *vs* 87.5 ± 18.2; 102.1 ± 28.6 *vs* 78.3 ± 14.1; all $P < 0.05$). Abdominal distension, belching and early satiety had an effect on distal gastric half-emptying time ($P < 0.05$). Abdominal distension and abdominal pain had an effect on the gastric half-emptying time of the whole stomach ($P < 0.05$). All were risk factors (odds ratio > 1). The total symptom score of the 3 groups after treatment was lower than before treatment ($P < 0.05$). Total symptom scores after treatment in the *H. pylori*-treatment group and *H. pylori*-negative group were lower than in the conventional treatment group (5.15 ± 2.27 *vs* 7.02 ± 3.04, 4.93 ± 3.22 *vs* 7.02 ± 3.04, All $P < 0.05$). The gastric half-emptying times of the proximal end, distal end, and the whole stomach in the *H. pylori*-negative and *H. pylori*-treatment groups were shorter than in the conventional treatment group ($P < 0.05$).

CONCLUSION: FD patients have delayed gastric emptying. *H. pylori* infection treatment helps to improve symptoms of dyspepsia and is a reasonable choice for treatment in clinical practice.

Key words: Functional dyspepsia; Gastric emptying; Ultrasound

Core tip: Stomach half-emptying time was determined in *Helicobacter pylori* (*H. pylori*) patients and healthy controls. The half-emptying times at the proximal end, distal end, and the whole stomach in the functional dyspepsia (FD) group were slower than in the control group. Total symptom scores in the *H. pylori*-treatment group and *H. pylori*-negative group were lower than in the conventional treatment group after treatment. Patients with FD have delayed gastric emptying. Treatment of *H. pylori* infection helps to improve symptoms of dyspepsia and is a reasonable choice for therapy in clinical practice.

Zhang CL, Geng CH, Yang ZW, Li YL, Tong LQ, Gao P, Gao YQ. Changes in patients' symptoms and gastric emptying after *Helicobacter pylori* treatment. *World J Gastroenterol* 2016; 22(18): 4585-4593 Available from: URL: http://www.wjgnet.com/1007-9327/full/v22/i18/4585.htm DOI: http://dx.doi.org/10.3748/wjg.v22.i18.4585

INTRODUCTION

Functional dyspepsia (FD) is the most common functional gastrointestinal disorder, but its etiology remains unclear[1-3]. However, it is generally believed that an abnormality in gastric motility is an important factor[4]. Patients with FD often appear to have abdominal distension, belching, nausea, and other symptoms of dyspepsia. In severe cases, it has a major impact on daily life, and treatment is required to alleviate the symptoms[5-7]. FD is associated with a variety of factors that include gastrointestinal motility disorders, gastrointestinal hormone secretion abnormalities, or *Helicobacter pylori* (*H. pylori*) infection[8]. Among them, *H. pylori* infection probably induces symptoms by increasing the sensitivity to mechanical distension or increasing gastric acid secretion[9]. Clinically, gastric motility drug treatment is primarily given to these patients. However, whether there is a need for eradication therapy for *H. pylori* in FD patients remains controversial[10]. Furthermore, determination of gastric emptying by ultrasound is convenient for observation, has economic advantages, is easy for patients, and is suitable for widespread or repeated use[11,12]. Therefore, this study compared symptoms of dyspepsia, gastric emptying time, and other indicators before and after *H. pylori* treatment in patients with FD in our hospital, and in healthy volunteers. The relationship between the symptoms of dyspepsia and gastric half-emptying time were observed in FD patients, and whether *H. pylori* treatment could alleviate the symptoms was investigated, with the aim of providing a basis for the clinical treatment.

MATERIALS AND METHODS

Study population

A total of 70 adult FD patients admitted to our hospital from January 2013 to March 2015 were included in this study as the FD group, and were divided into 2 groups: *H. pylori*-negative group ($n = 28$) and *H. pylori*-positive group ($n = 42$). The *H. pylori*-positive group was further randomly divided into 2 groups: an *H. pylori* treatment group and a conventional treatment group ($n = 21$ each group). Patients with

Table 1 Comparison of baseline characteristics between the functional dyspepsia and control groups

Group	Age	Sex (male/female)	BMI (kg/m^2)	Duration of disease (yr)
FD group (n = 70)	44.82 ± 13.41	27/43	21.38 ± 3.87	2.01 ± 1.32
Control group (n = 72)	40.70 ± 6.39	22/48	21.20 ± 2.95	1.89 ± 1.73
t-test value	t = 2.347	χ^2 = 0.785	t = 0.312	t = 0.464
P value	0.020	0.376	0.755	0.644
H. pylori therapeutic group	42.73 ± 11.97	10/18	20.98 ± 3.27	2.10 ± 1.12
Conventional therapeutic group	43.79 ± 14.28	9/12	22.08 ± 2.96	1.97 ± 1.28
H. pylori-negative group	45.82 ± 12.83	8/13	21.16 ± 3.64	1.95 ± 1.31
t-test value	F = 2.191	F = 2.315	F = 1.923	F = 1.872
P value	0.266	0.221	0.397	0.426

BMI: Body mass index; FD: Functional dyspepsia; *H. pylori*: *Helicobacter pylori*.

FD met the following criteria[13]: (1) the Rome Ⅲ diagnostic criteria of FD; (2) duration of disease 1-3 years, with no gastrointestinal motility or *H. pylori* drug treatment in the previous month; (3) had not been treated with systematic FD or *H. pylori* drugs; and (4) underwent pathological examination by gastroscopy and a ^{13}C-urea breath test. *H. pylori*- positive patients were required to have 2 positive checks, and excluded single-positive patients. In addition, 72 healthy adults were selected from the Medical center as the control group. None of the subjects had the following exclusion criteria[13]: (1) organic lesions in the stomach and duodenum revealed by endoscopic examinations; (2) history of gastrointestinal surgery; (3) diabetes or connective tissue diseases; and (4) long-term smoking or alcoholism. Age and other characteristics were similar between the FD group and control group (P > 0.05, Table 1).

Methods

A GE Voluson E8 ultrasound with a C1-5 transducer was used for examination of all subjects by an experienced sonographer. Subjects were not allowed to drink and eat 12 h before the ultrasound examination, and the empty state of the stomach was confirmed before examination[14]. Patients were asked to finish a 500 mL standard test meal within 4-5 min (500 mL of 80 g black sesame paste in boiled water, cooled to about 25 ℃; about 1960 kJ)[15]. With patients in a sitting position, the abdomen between the xiphoid and navel was first scanned by an ultrasound 4C1 convex array probe The "figure-of-eight-like" double ring sign (Figure 1) junction is the angulus, which is the boundary between the proximal end and distal ends of the stomach. The proximal and distal stomach areas were measured immediately after patients took the test meal and at 20, 40, 60, and 90 min thereafter, and gastric half-emptying time was obtained by computer analysis.

FD patients in the *H. pylori*-negative group and conventional treatment group were given domperidone 0.6 mg/kg/d 30 min before a meal for 1 mo; while patients in the *H. pylori* treatment group took a combination of 3 drugs as eradication therapy for *H. pylori*, including lansoprazole tablets 30 mg once daily, clarithromycin tablets 0.5 g twice daily, and amoxicillin 1.0 g twice daily for 1 wk. Confirmation of *H. pylori* eradication was performed with a gastroscope and ^{13}C-urea breath test. Then domperidone 0.6 mg/kg per day) was given 30 min before a meal for 1 mo. Dyspepsia symptoms pre-and-post treatment were scored in all these groups. Gastric half-emptying time was determined after the end of treatment.

Evaluation index

Dyspepsia symptoms of all subjects were statistically compared, and the correlation with gastric half-emptying time was analyzed. Total dyspepsia symptom scores before and after treatment were compared and analyzed among the 3 groups of patients with FD. Symptom scores for abdominal pain, epigastric burning sensation, abdominal distension, nausea, belching, vomiting, and early satiety were scored according to the severity of symptoms: 0, asymptomatic; 1, mild (between asymptomatic and moderate); 2, moderate (symptoms that can be tolerated); 3, severe (symptoms that are intolerable and have a serious impact on daily life)[16,17]. Then, gastric half-emptying time after treatment was compared among the 3 groups of patients with FD.

Statistical analysis

SPSS 20.0 was used to analyze all data (IBM Corp., Armonk, NY, United States). P < 0.05 was considered statistically significant. The incidence of epigastric abdominal pain, epigastric burning sensation, abdominal distension, nausea, belching, vomiting, and early satiety symptoms was compared between the FD group and control group using the χ^2 test. Gastric half-emptying time: Gastric half-emptying time of the proximal end, distal end, and the whole gastric region was compared between the FD group and control group using the t-test. The relationship between dyspepsia symptoms and gastric half-emptying was determined using logistic regression analysis, with gastric half-emptying time as the dependent variable and the symptoms of dyspepsia as the independent variables. Total symptom scores before and after treat-

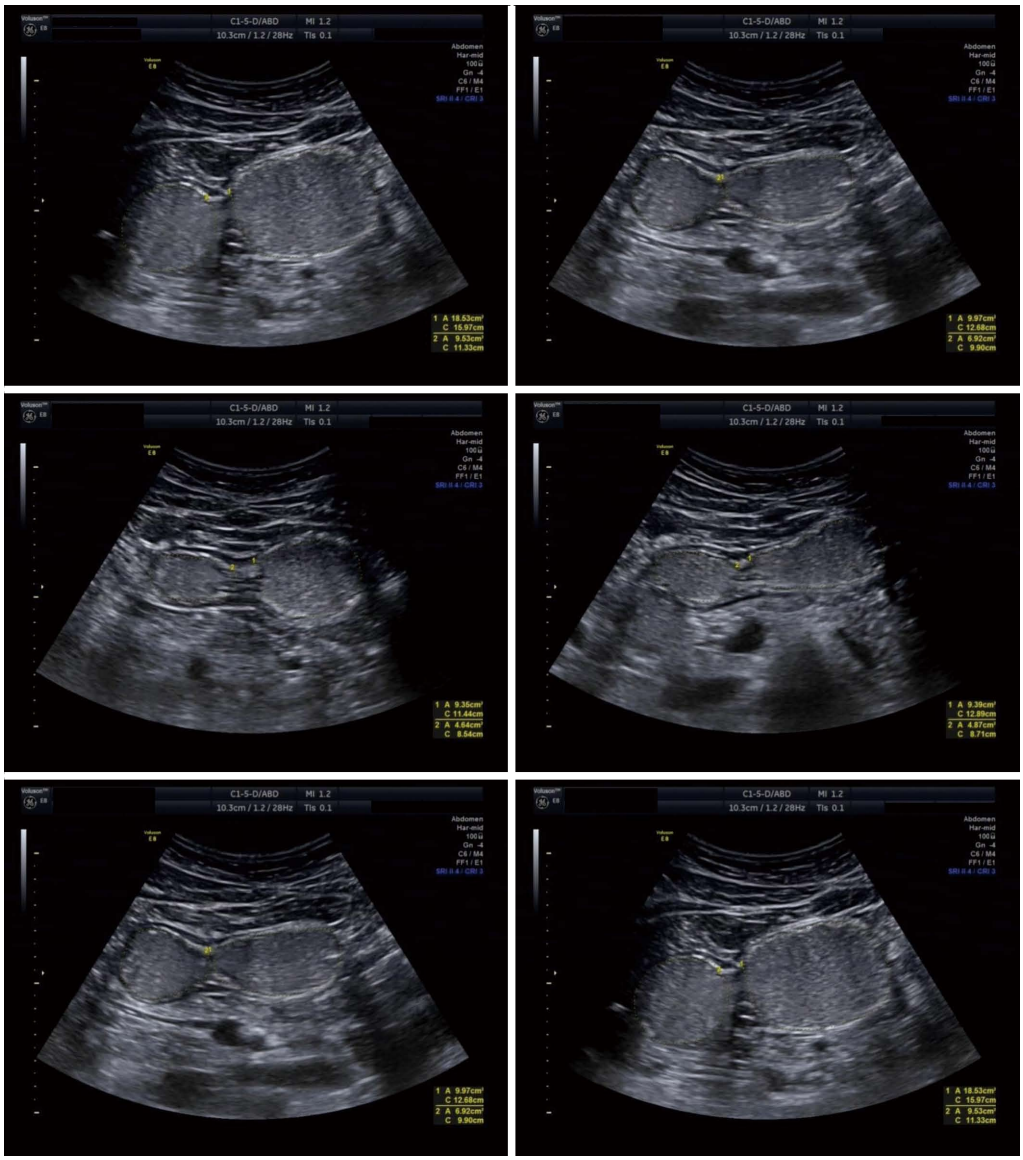

Figure 1 Gastric "figure-of-eight-like" double ring sign in different patients.

ment in the 3 groups of FD patients were compared by one-way analysis of variance (ANOVA test). The SNK-*Q* test was then performed for paired comparisons when the difference between groups was statistically significant. The gastric half-emptying times at the proximal end, distal end, and the whole gastric region after treatment among the 3 groups of patients were compared by ANOVA, followed by the SNK-*Q* test for paired comparisons.

RESULTS

Comparison of dyspepsia symptoms

The incidence of abdominal pain, epigastric burning sensation, abdominal distension, nausea, belching, and early satiety symptoms was significantly higher in patients in the FD group compared with the control group ($P < 0.05$). However, there was no significant difference in the incidence of vomiting between the 2 groups ($\chi^2 = 1.624$, $P = 0.203$), as shown in Table 2.

Comparison of gastric half-emptying conditions

Gastric half-emptying times at the proximal end, distal end, and the whole gastric region were significantly slower in the FD group than in the control group ($P < 0.05$, Table 3). As observed from the gastric emptying curve for the 2 groups, gastric contents in the proximal end presented a gradual downward trend in the control group, which slowed down between 40 min and 60 min. However, the rate of decline was slower in the FD group compared with the control group, and the decline between 40 and 60 min time points was significantly slower, presenting a plateau phase. The control group continued to present a slow downward trend in the gastric emptying curve at the distal end. However, the curve presented an upward and a downward trend in the FD group within the first 20 min after eating, and was slower than that in the

Table 2 Incidence of dyspeptic symptoms in functional dyspepsia and control groups *n* (%)

Groups	Abdominal pain	Epigastric burning sensation	Abdominal distension	Nausea	Belching	Vomiting	Early satiety
FD group (n = 70)	35 (50.0)	26 (37.1)	55 (78.6)	32 (45.7)	37 (52.9)	11 (15.7)	40 (57.1)
Control (n = 72)	15 (20.8)	9 (12.5)	32 (44.4)	16 (22.2)	5 (15.3)	7 (9.7)	14 (19.4)
χ^2 value	18.642	16.224	24.699	12.314	31.456	1.624	30.087
P value	0.000	0.000	0.000	0.000	0.000	0.203	0.000

FD: Functional dyspepsia.

Table 3 Comparison of gastric half-emptying time between functional dyspepsia and control groups

Groups	Gastric half-emptying time at the proximal end (min)	Gastric half-emptying time at the distal end (min)	Gastric half-emptying time at the whole gastric region (min)
FD group (n = 70)	93.7 ± 26.2	102.2 ± 26.4	102.1 ± 28.6
Control group (n = 72)	72.0 ± 14.3	87.5 ± 18.2	78.3 ± 14.1
t value	6.149	3.782	6.316
P value	0.000	0.000	0.000

FD: Functional dyspepsia.

control group. In the gastric emptying curve of the whole gastric region, the control group continued to present a slow downward trend. However, the curve for the FD group declined at different rates (Figure 2).

Relationship between symptoms of dyspepsia and gastric half-emptying time

There was no significant association of any of the symptoms with prolonged gastric half-emptying time at the proximal end (P > 0.05). However, abdominal distension, belching, and early satiety was associated with abdominal distension at the distal end (P < 0.05), and were risk factors for delayed gastric half-emptying time at the distal end (OR > 1). Abdominal distension and abdominal pain were associated with gastric half-emptying time of the whole gastric region (P < 0.05), and were risk factors for delayed gastric half-emptying of the whole gastric region (OR > 1, Table 4).

Total score of patients with symptoms of dyspepsia occurring before and after treatment

There was no statistically significant difference in total patient symptom scores before treatment among the 3 groups (F = 3.021, P = 0.291). However, the scores were lower after treatment than before treatment, and the difference was statistically significant (P < 0.05). There was a statistically significant difference in scores after treatment among the 3 groups (F = 3.162, P = 0.014). Pairwise comparisons showed total symptom scores after treatment were significantly lower in the *H. pylori* treatment group and *H. pylori*-negative group than in the conventional treatment group (*H. pylori* treatment group: Q = 2.259, P = 0.029; *H. pylori*-negative group: Q = 2.163, P = 0.037); however, there was no significant difference between the *H. pylori* treatment group and *H. pylori*-negative group (Q = 0.270, P = 0.791; Table 5).

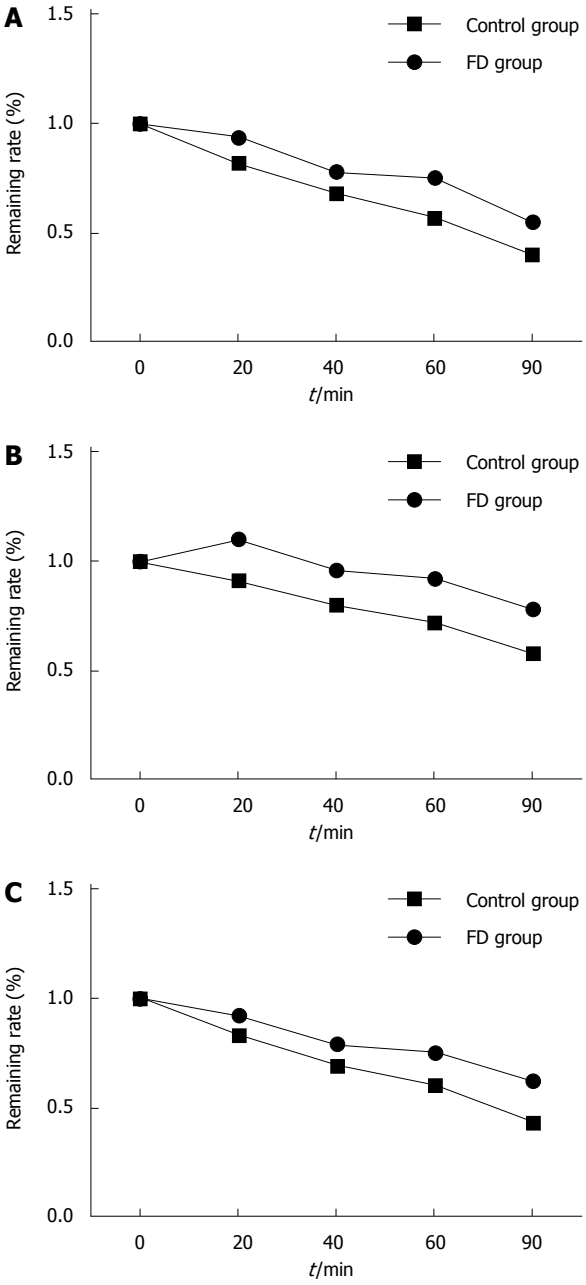

Figure 2 Gastric emptying curves. A: Proximal end; B: Distal end; C: Whole gastric region.

Table 4 Logistic regression analysis of symptoms of dyspepsia and gastric half-emptying time

Influential factors	Prolonged gastric half-emptying time	β	SE	Wald value	OR	95%CI	*P* value
Abdominal pain	Proximal	0.255	0.322	5.743	1.291	0.687-2.426	0.791
	Distal	0.123	0.429	6.841	1.131	0.488-2.622	0.387
	Whole	0.780	0.117	15.935	2.182	1.735-2.744	0.008
Epigastric burning sensation	Proximal	0.653	0.412	6.472	1.921	0.857-4.308	0.391
	Distal	-0.272	0.366	5.937	0.762	0.372-1.561	0.752
	Whole	-0.183	0.621	6.935	0.833	0.247-2.814	0.326
Abdominal distension	Proximal	-0.451	0.429	7.299	0.637	0.275-1.477	0.261
	Distal	0.600	0.128	15.643	1.823	1.419-2.343	0.016
	Whole	0.273	0.118	14.984	1.314	1.043-1.656	0.021
Nausea	Proximal	0.545	0.529	8.327	1.725	0.612-4.865	0.134
	Distal	0.205	0.326	7.565	1.227	0.648-2.325	0.142
	Whole	0.699	0.762	7.418	2.011	0.452-8.954	0.221
Belching	Proximal	0.023	0.376	7.488	1.023	0.490-2.138	0.172
	Distal	0.745	0.223	12.473	2.106	1.360-3.260	0.031
	Whole	-0.583	0.515	9.304	0.558	0.203-1.531	0.086
Early satiety	Proximal	-0.467	0.718	8.471	0.627	0.153-2.561	0.096
	Distal	0.461	0.202	13.845	1.585	1.067-2.355	0.026
	Whole	-0.028	0.486	8.737	0.972	0.375-2.520	0.093

Table 5 Comparison of total symptom scores of patients before and after treatment

Groups	Before treatment	After treatment	*Q* value	*P* value
H. pylori treatment group (n = 21)	10.14 ± 4.02	5.15 ± 2.27	4.953	0.000
Conventional treatment group (n = 21)	11.01 ± 3.92	7.02 ± 3.04	3.686	0.001
H. pylori-negative group (n = 28)	11.61 ± 4.81	4.93 ± 3.22	6.107	0.000

H. pylori: *Helicobacter pylori*.

Table 6 Comparison of gastric half-emptying time (min) of patients after treatment

Groups	Gastric half-emptying time at the proximal end	Gastric half-emptying time at the distal end	Gastric half-emptying time at whole gastric region
(1) *H. pylori* treatment group (n = 21)	74.0 ± 12.4	87.7 ± 13.4	80.3 ± 14.4
(2) Conventional treatment group (n = 21)	83.1 ± 15.8	97.5 ± 15.1	91.9 ± 17.2
(3) *H. pylori*-negative group (n = 28)	73.6 ± 11.7	88.3 ± 15.4	79.8 ± 15.9
F value	3.211	3.143	3.188
P value	0.004	0.019	0.007
(1):(2) *Q* value	2.076	2.225	2.37
P value	0.044	0.032	0.023
(1):(3) *Q* value	0.115	0.143	0.107
P value	0.909	0.887	0.915
(3):(2) *Q* value	2.317	2.087	2.516
P value	0.025	0.042	0.015

H. pylori: *Helicobacter pylori*.

Gastric half-emptying time after treatment

There was a statistically significant difference in gastric half-emptying time at the proximal end, distal end, and whole gastric region after treatment among the 3 groups ($P < 0.05$). Pairwise comparisons showed that gastric half-emptying times at the proximal end, distal end, and whole gastric region were significantly shorter in the *H. pylori*-negative group and *H. pylori* treatment group compared with the conventional treatment group ($P < 0.05$); while there was no significant difference between the *H. pylori* treatment group and *H. pylori*-negative group ($P > 0.05$, Table 6).

DISCUSSION

In patients with FD, although there is no organic disease, belching, nausea, abdominal pain, and other symptoms of dyspepsia can continue for more than 6 mo, and if symptoms persist for 3 mo or more, there is a greater impact on the quality of life[17-20]. The incidence of FD is about 20%, and is mostly caused by gastric motility disorders, including abnormal gastric emptying, stomach discomfort from reduced capacity, and gastric electrical rhythm abnormalities[21-24]. The stomach can be divided into 2 regions at the angulus, and the proximal and distal regions function differently to some extent. The proximal region mainly functions to receive and store food, and control liquid emptying. The distal region may conduct peristalsis to grind the food and mix it with the gastric juice[25-29]. Observation of gastric emptying by ultrasound is a simple method, does not cause injury, and is easily accepted by patients. Therefore, gastric emptying studies by ultrasound observation enable the comparison of the relationship between the symptoms of patients with FD. In this study, a comparative analysis was performed for gastric emptying and various common FD symptoms in the proximal end, distal end and full stomach. *H. pylori* infection affects the endocrine aspects of the smooth muscle in the human gastro-

intestinal tract, and this is generally considered to have a significant impact on the symptoms in patients with FD[30-32]. Therefore, in this study, *H. pylori*-positive and -negative symptoms and gastric emptying between healthy subjects and patients with FD were compared in order to observe the effects of *H. pylori* infection in FD patients.

The study revealed that the incidence of symptoms in the FD group, except vomiting, was high compared with the control group. Gastric half-emptying time at the proximal end, distal end, and the whole gastric region was slower in the FD group than in the control group. Abdominal distension, belching, and early satiety were associated with gastric half-emptying time at the distal end. Abdominal distension and abdominal pain were associated with gastric half-emptying time of the whole gastric region. Total symptom scores of patients in the 3 groups decreased after treatment. In the *H. pylori*-negative group and *H. pylori* treatment group, total symptom scores after treatment were lower compared with the conventional treatment group; and gastric half-emptying times at the proximal end, distal end, and the whole gastric region were shorter than in the conventional treatment group. However, there was no difference between the *H. pylori* treatment group and *H. pylori*-negative group. It can be observed that delayed gastric emptying and *H. pylori* infection have an important impact on the occurrence of symptoms in FD patients. As observed from the gastric emptying curve at the distal end after eating, the amount of food inside the stomach at the distal end increased and slowly declined. It is considered that this is because the proximal end of the stomach suffers from receptive dysfunction for food. When food increases, relaxation is delayed, resulting in regurgitation or the rapid discharge of food into the distal end, causing FD patients to have early satiety, abdominal distension, and other symptoms[33-36]. In addition, the abnormal distribution of food at the proximal and distal end of the stomach further affects the emptying of food, resulting in the occurrence of symptoms of dyspepsia[37].

After administration of drugs promoting gastric motility to patients, the clinical symptoms of FD patients were alleviated regardless of whether *H. pylori* infection was present or not. As observed, abnormal gastric motility is an important reason for the occurrence of FD symptoms. *H. pylori* eradication treatment to improve symptoms and gastric emptying of *H. pylori*-positive patients is better than no *H. pylori* eradication treatment. It has been considered that *H. pylori* participate in the occurrence of FD symptoms through a variety of mechanisms[9]. This includes *H. pylori* infections in the gastrointestinal tract causing an increase in mechanical expansion sensitivity[38,39]. *H. pylori* infection can directly lead to increased gastric acid secretion or promote gastric acid secretion by increasing gastrin, leading to abdominal pain, epigastric burning sensations, and other symptoms[40]. *H. pylori* infection can cause gastrointestinal hormone secretion disorders, such as increased somatostatin and cholecystokinin, leading to an increase in the incidence of symptoms in patients with FD[41-44]. *H. pylori* infection affects gastric emptying, and influencing factors include increased release of leukotrienes[45,46], or nitric oxide and other substances. This leads to gastrointestinal smooth muscle relaxation and delayed gastric emptying, or an increase in 5-HT and other substances affecting gastrointestinal smooth muscle contraction, resulting in gastrointestinal tract motility disorders[47-50].

As the amount of samples collected in this study was small and it was a single center study, the relationship between symptoms of dyspepsia in patients with FD, gastrointestinal tract motility disorders, and *H. pylori* infections requires further larger scale investigations to further determine the pathophysiological mechanisms in order to provide good guidance for clinical diagnosis and treatment of patients with FD.

In summary, gastric emptying is delayed to some extent in patients with FD. For patients infected with *H. pylori*, *H. pylori* eradication treatment helps to improve dyspepsia symptoms. This may be a reasonable choice for therapy in clinical practice.

COMMENTS

Background

Functional dyspepsia (FD) is the most common functional gastrointestinal disorder, but the etiology remains unclear. Patients with FD often appear to have abdominal distension, belching, nausea, and other symptoms of dyspepsia. In severe cases, it seriously impacts their daily life. FD is related to a variety of causes that include gastrointestinal motility disorders, gastrointestinal hormone secretion abnormalities, or *Helicobacter pylori* (*H. pylori*) infection. However whether there is a need for eradication therapy for *H. pylori* in FD patients remains controversial. Therefore, the study investigated the relationship between symptoms of dyspepsia and gastric half-emptying time in FD patients, and whether *H. pylori* treatment could alleviate the symptoms, to provide a basis for clinical treatment.

Research frontiers

In recent years, FD incidence has gradually increased and its cause is unknown. Studies have reported that *H. pylori* infection can cause gastrointestinal hormone secretion disorders such as increased somatostatin and cholecystokinin secretion, leading to a corresponding increase in the incidence of symptoms in patients with FD. The symptoms of FD are mostly caused by gastric motility disorders, including abnormal gastric emptying, stomach discomfort from reduced capacity, and gastric electrical rhythm abnormalities. The use of ultrasound to observe gastric emptying, and compare symptoms score, is a simple and effective method.

Innovations and breakthroughs

FD is mostly caused by gastric motility disorders including abnormal gastric emptying. Gastric emptying observation by ultrasound is a simple and effective method, does not cause injury, and is easily accepted by patients. Using symptom scoring for a variety of FD symptoms, a more comprehensive evaluation of symptoms can be made.

Applications

This study demonstrated that patients with FD have delayed gastric emptying. *H. pylori* infection treatment helps to improve symptoms of dyspepsia. FD is closely associated with abnormal gastric emptying and *H. pylori* infection. This provides a basis for clinical treatment with gastrointestinal motility drugs and *H.*

pylori eradication therapy in FD patients.

Peer-review

This study compared and analyzed the gastric emptying and symptoms between FD patients and healthy people; *H. pylori* positive group, *H. pylori*-negative group and the conventional treatment. It demonstrates that patients with FD have delayed gastric emptying. *H. pylori* infection treatment helps to improve symptoms of dyspepsia. Provide a reliable basis to applications gastrointestinal drugs and drugs to cure *H. pylori* for the treatment of patients with *H. pylori*.

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P- Reviewer: Handan OB, Thornton GD **S- Editor**: Ma YJ
L- Editor: Cant MR **E- Editor**: Ma S

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ISSN 1007-9327