Gastric myoelectrical activity and gastric emptying in diabetic patients with dyspeptic symptoms

Hui-Bin Qi, Jin-Yan Luo, You-Ling Zhu, Xue-Qin Wang

INTRODUCTION

Recently, electrogastrography (EGG) has received more and more attention. Although gastroenterologists in its clinical application, concerns remain to the reliability and analysis of the EGG and the correlation between the EGG and gastric motility. This study was to investigate gastric myoelectrical activity and gastric emptying (GE) and their relationship in diabetic patients with dyspeptic symptoms using electrogastrography and isotopic method.

MATERIALS AND METHODS

Subjects

The study was performed on 22 healthy asymptomatic subjects (11 women, 11 men; mean age 50 yr) and 32 non-insulin-dependent diabetes mellitus (NIDDM) patients with dyspeptic symptoms (15 women, 17 men; mean age 51 yr) based on clinical and laboratory diagnoses. NIDDM was diagnosed by the WHO criteria (1980). All patients had a minimum 3-month history of chronic, persistent, or recurrent epigastric pain and fullness, early satiety, nausea and/or vomiting. The result of esophagogastroduodenoscopic examination were negative for any focal lesions, including esophagitis, gastric or duodenal ulcers or erosions, or esophageal or gastric malignancy. Exclusion criteria were: history of abdominal surgery, history of gastrointestinal reflux disease or irritable bowel syndrome, evidence of cardiovascular, pulmonary, hepatic, or renal disease. All subjects fasted an overnight before the study and took no medications known to affect gastrointestinal motility during 3 d before the study.

Gastric emptying test

Gastric emptying test was taken by using SPECT technique. The standard meal for gastric emptying test consisted of 100 g scrambled eggs labeled with 99mTc-DTPA (11.1 MBq) and 200 mL of water. After eating, the anterior/posterior images of the stomach were taken by the same operator using a technetium scanner for 2 h. Retention and half-emptying time (T1/2) were calculated by a specialist at the Department of Nuclear Medicine. Delayed gastric emptying was defined as the half-emptying time > x + 2s as controls.

Recording of gastric myoelectrical activity

Gastric myoelectrical activity was measured with surface EGG. The EGG recording including a 30-min fasting study using an EGG recording unit (Digitrapper, Synectics Medical, Sweden), after which the patient ate a standard test meal (1883 J). This was immediately followed by another 30-min recording. The EGG data was analyzed by the “multigram” Synectics software package running on a personal computer. The EGG parameters including dominant frequency (DF), dominant power (DP), postprandial / preprandial DF, postprandial / preprandial DP.

RESULTS

Gastric emptying test

The mean percentage of gastric retention and half-emptying time in diabetic patients with dyspeptic symptoms were substantially higher than in the healthy subjects (Table 1). Of 32 patients, 15 (47%) had delayed gastric emptying. Of 22 controls, 1 (5%) had delayed gastric emptying. The incidence of gastric emptying delay was higher in patients than in controls (P<0.01).

Table 1 Gastric Emptying In NIDDM (x±s)

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>30min</th>
<th>60min</th>
<th>90min</th>
<th>120min</th>
<th>T1/2</th>
<th>x±s</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIDDM</td>
<td>32</td>
<td>75±7</td>
<td>61±8</td>
<td>54±10</td>
<td>43±10</td>
<td>92±10</td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>22</td>
<td>61±7</td>
<td>45±6</td>
<td>33±4</td>
<td>24±10</td>
<td>49±9</td>
<td></td>
</tr>
</tbody>
</table>

P<0.05 vs controls; *P<0.01 vs controls

Electrogastrographic findings

EGG dominant frequency corresponds to gastric slow wave. DF ranging from 2.4 to 3.7 cycle per min (cpm) was considered as normogastria, DF<2.4 cpm was defined as bradygastria, DF>3.7 cpm was defined as tachygastria. DF<2.4 cpm and/or DF>3.7 cpm was defined as dysrhythmia or abnormal EGG. The patients had a lower incidence of normogastria than did controls both in the fed state (34% vs 86%, P<0.01) and in the fasting state (38% vs 96%, P<0.01). However, the patients had a higher incidence of dysrhythmia (tachygastria and bradygastria) than did controls both in the fed state (66% vs 14%, P<0.01) and in the fasting state (63% vs 5%, P<0.01). The mean postprandial dominant frequency and postprandial/preprandial dominant frequency ratio were lower in patients than in controls (2.61±0.29 cpm vs 3.76±0.14 cpm, P<0.05; 1.01±0.10 vs 1.28±0.11, P<0.05). The mean postprandial dominant power increase and the mean postprandial/preprandial dominant power ratio was significantly less in the patients than in the controls (121.50±67.02 V2·cpm vs 688.61±72.73 V2·cpm, P<0.01; 0.71±0.60 vs 2.40±0.61, P<0.01). No differences were found in the mean preprandial dominant frequency and the mean preprandial dominant power (2.57±0.24 cpm vs 2.91±0.22 cpm, P>0.05; 144.10±27.40 V2·cpm vs 288.40±56.72 V2·cpm, P>0.05).

Comparison of EGG and gastric emptying

Of 32 diabetic patients with dyspeptic symptoms, 15 (47%) had...
delayed gastric emptying and 21 (66%) patients with dysrhythmia. 12 patients with dysrhythmia had slow gastric emptying. There was no significant correlation between gastric electrical rhythm and gastric emptying (P=0.05).

**DISCUSSION**

Gastric emptying and EGG were measured in diabetic patients with dyspeptic symptoms in this study. The results showed that fifteen of 32 (47%) diabetic patients with dyspeptic symptoms had delayed gastric emptying, and 21 of 32 (66%) patients had abnormal gastric myoelectrical activity. 12 patients with dysrhythmia had slow gastric emptying. The major abnormalities in gastric myoelectrical activity observed in diabetic patients with dyspeptic symptoms were the abnormal rhythmicity of the gastric slow wave and the reduced postprandial increase in the dominant power.

Our findings in this study are similar to those in previous studies in patients with various gastric motor disorders[14-19]. In studies using cutaneous electrodes, abnormal EGG were found in 50% of patients with functional dyspepsia[14]. In an electrogastrographic study using cutaneous electrodes, a high proportion of adult patients (60%) with functional dyspepsia had abnormally slow gastric emptying and abnormalities in gastric myoelectrical activity[19]. We found that 66% of the patients had abnormal rhythmicity of the gastric slow wave (bradygastria and tachygastria) and some patients had a reduced postprandial increase in the dominant power. EGG findings similar to those in this study have been also reported in studies in patients with gastroparesis[20,21]. However, Pfaffenbach et al. reported that the EGG values obtained in diabetics did not differ significantly from those in healthy subjects and did not correlate with radioscintigraphy. The EGG values in diabetics with delayed gastric emptying (about 40%) did not differ from data in diabetics without gastroparesis[21]. Jebbink et al. also reported that no differences between patients with functional dyspepsia and healthy volunteers were found in the incidence of dysrhythmias[23]. These discrepancies probably result from differences in patient selection, differences in definition of dyspepsia and EGG analysis method[24]. Prior studies have demonstrated that gastric emptying in dyspeptic patients was found to be delayed in 30–80% of the patients[19,20,25-28]. In agreement with prior studies, this study demonstrated 47% delayed gastric emptying in diabetic patients with dyspeptic symptoms. The present study shows that 12 patients with dysrhythmia had delayed gastric emptying, but there was no correlation between gastric rhythmicity and gastric emptying. An other interesting finding was the reduced increment of amplitude (power), expressed as absolute or relative changes (fed/fasting power ratio). A possible cause for a decrease in the power ratio was the reduced gastric distention or and contractility of the stomach. A increase in amplitude were reported in numerous studies in normal adults and in normal children[29-32]. Some authors believed that it was related to the increased contractility of the stomach after the meal[30,33,35], whereas others reported a major effect of gastric distention. Faure et al. suggested that both gastric distention and motor activity contributed to the increase in EGG amplitude, the greater contribution being attributable to gastric distention[36]. Gastric emptying and EGG findings were agreement with our finding in previous study[37] and other authors’ findings[38]. A study by Barbar et al. showed that EGG did not correlate with nuclear scintigraphic gastric emptying studies in children with suggestive symptoms of gastric motility disorders[38]. Zhang et al. reported that they can’t predict a delayed GET by an abnormal EGG[39]. However, controversial findings were reported. Pfaffenbach et al. reported that in 25 adult patients with functional dyspepsia, patients with delayed gastric emptying showed significantly more pre- and post pradial tachygastrias than patients with normal gastric emptying[40]. Gastric emptying is a complex procedure. EGG reflects gastric myoelectrical activity and gastric emptying reflects gastric motility. so EGG and gastric emptying should complement each other in studying gastric motor disorders[14,41].

In conclusion, diabetic patients with dyspeptic symptoms have delayed gastric emptying and abnormalities in gastric myoelectrical activity including dysrhythmia and the reduced postprandial increase in the dominant power. However, the abnormal EGG isn’t able to predict delayed gastric emptying.

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