Effect of sham feeding on gastrointestinal hormone and the quality of bowel preparation in patients with Polyethylene Glycol Electrolytes solution

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ABSTRACT

Objective: To investigate whether sham feeding before colonoscopy can affect gastrointestinal hormone and compliance of colonoscopy patients when taking polyethylene glycol solution, so as to provide reference for effective intervention programs. Methods: A total of 110 patients undergoing colonoscopy were randomized into a control group and a sham feeding group, with 55 patients in each group. Patients in control group only received polyethylene glycol (PEG) solution before colonoscopy. Patients in gum group chewed gum after taking PEG solution. Serum motilin, gastrin and cholecystokinin were tested with ELISA assay. Intestinal tract cleanliness was assessed by the Boston Bowel Preparation Scale and patients’ discomfort and intake compliance by a self-designed questionnaire. Results: The serum motilin of sham feeding for 4 h were lower than that of control group, the incidence of abdominal distention and nausea in sham feeding group was lower than that in control group, and the intake compliance and the speed of peristalsis was better, but there was no statistical significance found in the total score of intestinal tract cleanliness, difficulty and time of endoscopic operation. There was no statistical significance between the two groups regarding cecal intubation rate and colonoscopic findings. Conclusions: patients with gum chewing increase serum motilin and accelerating speed of peristalsis, it can not enhances colonoscopy bowel preparation quality, but improved abdominal discomfort, and intake adherence of patients in colonoscopy preparation.

1. Introduction

Colonoscopy plays a key role in screening various intestinal diseases[1]. The ideal intestinal environment is the premise for the smooth operation of colonoscopy. It not only provides basis for observing the intestinal environment, obtaining intestinal tissue specimen accurately, and endoscopic treatment, but also reduces the risk of local infection after operation[2]. Inadequate bowel preparation can reduce the rate of successful cecal intubation and disease detection, it also extend operating time, increase pain during examination and medical costs[3,4]. Polyethylene glycol electrolyte powder (PEG) has become the first choice for bowel preparation[5]. Barkun et al[6] have already reported that 5% to 38% of patients were unable to complete the standard regimen for taking PEG solution, resulting in less effective bowel preparation, and they probably have abdominal distension, nausea, vomiting and other abdominal discomfort symptoms during medication. In recent years, some studies have shown that sham feeding, such as chewing gum, has a positive effect on the recovery of intestinal function and the improvement of postoperative physiological discomfort. However, There are few studies reported the effects of chewing gum on gastrointestinal motility and bowel preparation quality when taking intestinal cleaners[7-10].

The aim of our study was to explore chewing gum as a simple,
safe and low-cost intervention whether can improve the quality of bowel preparation, reduce the discomfort in patients undergoing colonoscopy, and explore its possible mechanism.

2. Study sample

A total of 110 patients with colonoscopy under general anesthesia were selected from Central South University Xiangya School of Medicine affiliated Haikou Hospital. We explained the contents of the experiment to the patient and their family, and signed the informed consent before the operation. The study was approved by the ethic committee of hospital, all researchers met the indications for colonoscopy and excluded contraindications. Inclusion criteria: (1) age 18 to 65 years old. (2) could chew gum as required. (3) had drunk 2 L of PEG solution to complete bowel preparation as doctor’s advice. Exclusion criteria: (1) < 18 or > 65 years old. (2) had the history of major abdominal surgery. (3) single denture or more (chewing gum group). (4) mental illness. (5) pregnant women. (6) the patients with poor compliance. (7) other situations that researchers did not consider patients suitable for the study.

A total of 110 patients completed the experiment, among them, 4 patients were retired, 3 patients were incomplete, and 1 patients changed other way due to poor bowel preparation. Finally, the control group was 54 cases, and the sham feeding group was 52 cases. There was no significant difference in gender, age, and body mass index (BMI) between the two groups ($P=0.665$, $0.062$, $0.283$, Table 1).

2. Methods

2.1 Groups

The patients were divided into sham feeding group (55 cases) and control group (55 cases) by random number table method. control group: One day before the test, the low-fiber diet was taken. Two hours before the test, 2 L of the PEG solution was taken in one hour. The control group did not allow any food to be chewed. Sham feeding group: the method of ingesting the PEG solution was the same as the control group, the difference from the control group is that patients required to chew 2 sugar-free chewing gums about 15 min once per hour. In other word, patients chew sugar-free chewing gums once per hour after drinking 2 L of PEG solution, 8 chewing gums totally.

2.2 Evaluation criteria

2.2.1 Serum gastrin, motilin, and cholecystokinin

Three gastrointestinal hormone levels were measured by ELISA before chewing gum and 4 h after chewing.

2.2.2 The study take the questionnaire model

The following indicators 1-4 are filled by patients before the colonoscopy according to the situation during the medication, indicators 5-8 by the endoscopy physician according to the actual condition.

(1) Abdominal discomfort symptoms during the medication, such as nausea, vomiting, bloating, abdominal pain and other conditions, were collected by patients filling the questionnaire.

(2) Compliance assessed by the Likert scale, patients filled it according to the difficulty level of drinking PEG solution, divided into five levels (very difficult, difficult, general, easy, very easy).

(3) Intestinal peristalsis is assessed by the first defecation time and the last defecation time. The shorter the fecal emptying time, the faster the bowel movement. Patients filled questionnaire, including the time of drinking the PEG solution, the first defecation after taking the medicine, and the last defecation before the colonoscopy.

(4) Tolerance, patients assessed it according to whether they can accept colonoscopy as a physical examination item.

(5) Intestinal cleanliness, assessed by an endoscopic physician

Table 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Age</th>
<th>BMI</th>
<th>Gender</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sham feeding</td>
<td>52</td>
<td>41.62±12.88</td>
<td>21.76±3.38</td>
<td>Male</td>
<td>20</td>
<td>32</td>
</tr>
<tr>
<td>Control</td>
<td>54</td>
<td>45.98±10.87</td>
<td>22.43±2.99</td>
<td>Female</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td>$t$</td>
<td>-1.889</td>
<td>-1.079</td>
<td>0.188</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P$</td>
<td>0.062</td>
<td>0.283</td>
<td>0.665</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2.

Boston scale scoring standard.

<table>
<thead>
<tr>
<th>Score</th>
<th>Impression</th>
<th>Intestinal cleansing condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Poor</td>
<td>A lot of solid or semi-solid feces residue, which is not easy to suction or rinse, hinders observation seriously</td>
</tr>
<tr>
<td>1</td>
<td>Medium</td>
<td>Little or medium amount of semi-solid feces, granular or gelatinous feces residue, which is still partially obstructed by rinsing or suctioning.</td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>Very little, little or medium amount of mushy faeces or yellow clear liquid residue, which does not obstruct the observation after rinsing or suctioning.</td>
</tr>
<tr>
<td>3</td>
<td>Excellent</td>
<td>None or only little amount of yellow and clear liquid residue, clear observation.</td>
</tr>
</tbody>
</table>
over 5 years of working experience. The Boston Bowel preparation Scale (BBPS) was used to score and record after operation, such as suction and rinse. The entire colon is divided into 3 segments, left colon (including descending colon, sigmoid colon, rectum), transverse colon (including liver song, spleen), and right colon (including cecum, ascending colon). The cleanliness of each intestine is divided into 0-3 points, the scoring standard is shown in Table 2, the total score was the sum of three segments scores, the 8-9 points is excellent, 6-7 points is better, 4-5 points is acceptable, 2-3 points is poor, 0-1 points is unprepared.

(6) The detection rate of related diseases was recorded by endoscopic physician, including polyps, inflammatory bowel disease, cancer, etc. and was counted by the researchers.

(7) Intubation time, including insertion time and exit time, the shorter the operation time, to a certain extent, the more adequate the bowel preparation, the time recorded by the endoscopic physician who operated, and the statistics concluded by researchers.

(8) The degree of operative difficulty was scored by the Likert scale, endoscopic physician divided operative difficulty into five degree (very difficult, difficult, general, easy, very easy).

2.3 Statistical analysis

Data were analyzed using SPSS 20.0. The measurement data is expressed by the mean ± standard deviation, and the line t test conforms to the normal distribution, otherwise, rank sum test would be used. Count data is described by $\chi^2$ test. Height, weight, intestinal cleanliness score, fecal emptying time, motilin, gastrin and cholecystokinin were analyzed by independent sample t test or non-parametric test. Comparison of gender, adverse drug reactions, adherence and tolerance of patients, etc. were used by $\chi^2$ test or rank sum test, if $P<0.05$, the difference was statistically significant.

3. Results

3.1 Comparison of motilin before chewing gum and 4 h after chewing gum between the two groups

The level of plasma motilin increased 4 h after chewing gum in the sham feeding group ($P<0.05$). There was no difference in the levels of gastrin and cholecystokinin between the two groups ($P>0.05$) (Table 3). 

3.2 There was no statistically significant difference in intestinal cleansing between the two groups

There was no statistically significant difference in the scores of the Boston (Table 3) Intestinal Preparation Scale for each colon segment (right colon, transverse colon, left colon) ($P=0.208, 0.358, 0.512$) (Table 4).

3.3 Chewing gum can reduce adverse reactions during medication

There was no significant difference in the number of patients with vomiting and abdominal pain between the two groups. However, the number of nausea and bloating in the chewing gum group was lower than control group, and the difference was statistically significant (Table 5).

3.4 Chewing gum can improve patient tolerance and comfort during medication

We believe that whether or not patients accept colonoscopy as a physical examination item is equivalent to if patients are willing to undergo colonoscopy again, that is, the patient's tolerance to bowel preparation. More patients in the sham feeding group received
colonoscopy than those in the control group, and the difference was statistically significant (Table 5). Subjectively, the chewing gum group was better than the control group in the experience of self-consciously taking laxative.

3.5 Chewing gum can promote emptying of feces during medication

The chewing gum group was shorter than the control group at the beginning of defecation time and feces emptying time. The difference was statistically significant, but had no effect on the number of bowel movements (Table 7).

3.6 Chewing gum can not save operating time and reduce the difficulty of operation during medication

The average time for colonoscopy in both groups was approximately 13 minutes, and the difference was not statistically significant. In the chewing gum group, about 68% of patients, endoscopic physician think that the operation is difficult, easy in 25% of patients . In the control group, endoscopic physician think that operation is difficult in about 70% of patients, easy in about 11% of patients .

4. Discussion

Safety, effectiveness and tolerance are the three basic factors in assessing the quality of bowel preparation[6]. Safety is a basic premise and is generally considered to be more important than tolerance. However, the effectiveness of bowel preparation is inseparable from tolerance. Even if a intestinal cleanser has a good cleaning effect, but the tolerance is poor, the patient still cannot complete the bowel preparation and achieve the ideal examination effect. The best method of bowel preparation is to achieve a balance between effectiveness, tolerance, and safety.

Chewing exercise is a repeated oral local movement accompanied by nerve reflex activity, which is an essential physiological activity of the body[7]. As a simple and economical method of sham feeding, chewing gum can reduce the time of gastrointestinal motility and postoperative intestinal recovery after gynecological surgery[8–10] and gastrointestinal surgery[11]. Based on this, we suggest that sham feeding may facilitate intestinal preparation. Our study showed that the chewing gum group did not significantly improve the quality of intestinal cleansing compared with the control group, nor did it increase the detection rate of the disease and reduce the difficulty of colonoscopy, but it can reduce the incidence of nausea and bloating, improve comfort and tolerance.

Previous studies have reported a positive correlation between intestinal cleanliness and the number of bowel movements. In our study, serum motilin was reduced 4 h after taking medicine in sham feeding group. The mechanism may be that chewing gum can also act on the pharyngeal receptors, then stimulates the vagus nerve to cause relaxation of the fundus muscles and corpus muscles, resist the migratory movement caused by motilin to reduce the occurrence of discomfort such as nausea and vomiting[12]. Chewing gum can promote digestive tract activity through the mechanism of sham feeding[13]. It has also been reported that the combination of gastrointestinal motility drugs and PEG solution can significantly reduce intestinal adverse reactions, but has no effect on intestinal cleanliness[14], while chewing gum is essentially equivalent to taking gastrointestinal motility. Chewing gum has its own characteristics, it is not belong to drug and it is cheap, simple to operate, and has no adverse reactions. In addition, chewing is a way to relieve tension. Chewing gum can reduce anxiety, depression and other negative reactions[15,16].

In summary, although chewing gum can not improve intestinal cleanliness, it has a positive effect on comfort and tolerance. The most important is the method is safe, simple, and low cost. It can be recommended for patients who are preparing for bowel preparation.
by taking PEG solution. It helpful for improving comfort and tolerance. The mechanism of sham feeding to improve patient tolerance still needs more further research.

References


