Effect of Chewing Gum in reducing Postoperative Ileus after Gastro-duodenal perforation peritonitis surgery: a prospective randomized controlled trial

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Additional Declarations: No competing interests reported.
Abstract

Chewing gum reduces the duration of post operative ileus and early recovery of bowel function following elective abdominal surgery. However, its role has not been studied in cases of gastroduodenal perforation peritonitis; prompting us to conduct this study. Eighty-two patients were randomized into two groups, 39 patients received chewing gum (study group) and 43 patients were in control group. Sensation of hunger, appearance of first bowel sound, passages of flatus and faeces were significantly early in the study group; their hospital stay was also shorter. Chewing gum reduces the duration of post operative ileus in cases of gastroduodenal perforation peritonitis.

Registration number: IEC/2020-23/3359 dated 13-12-2020, Institutional Ethics committee Netaji Subhash Chandra Bose Medical College, Jabalpur, India.

Introduction

Prolonged postoperative ileus (POI) can delay the recovery of bowel function in 10-30% patients after abdominal surgery. [1] Delayed return of bowel function is an inevitable sequel of surgery for gastroduodenal perforation peritonitis (GDPP). Many systematic reviews and meta-analyses have shown reduced duration of POI and early recovery of bowel function with the use of Chewing gum (CG) following elective abdominal surgery. [2-6] However, its role has not been studied in cases of gastroduodenal perforation peritonitis; prompting us to conduct this study.

Methods

This prospective randomized control study was conducted in a tertiary care teaching hospital of central India from April 2021 to March 2023. Prior clearance was obtained from institutional ethics committee (IEC/2020-23/3359). Written informed consent was taken from all the eligible patients, who underwent Graham’s patch omentopexy for GDPP. On admission, all patients were prognosticated with a simple user-friendly Jabalpur scoring system (JPS) [7, 8]. All patients underwent Graham’s patch omentopexy, peritoneal lavage, and drainage using drain. In the post operative period those patients who died, required ventilatory support beyond six hours, or any other condition for which the intended treatment could not be started within the stipulated time were excluded. Included patients were randomized in two groups by computer generated random number. To reduce selection bias, randomization sequence was obtained on telephonic call from central surgical office, blinding was not feasible for both study and control groups. Patients in study group received sugar free chewing gum (Happy Dent, Xylitol; manufactured by Perfetti Van Melle, Gurugram, Haryana, India Pvt Ltd; cost INR 179 for a pack of 18.) started 6 hours after surgery, three times a day for 5 days, which the patient had to chew for 30 minutes; control group patients did not receive CG. Post operatively; sensation of hunger, appearance of time to first bowel sounds (TFBS), time to passages of first flatus (TFF) and, time to passages of first defecation (TFD) were recorded starting
from the day of surgery as was the length of hospital stay (LOHS). The bowel sounds were heard 6 hourly in four quadrants of abdomen. Nasogastric (NG) tube was inserted in all the patients at the time of surgery to decompress the gastric contents, it was removed when the daily output was reduced to 100ml. Enteral feeding was gradually started after the appearance of bowel sounds. Post operative antibiotics based on hospital antibiogram and other measures were similar in both the groups depending upon the need of individual patients as per the standard recovery protocol.

Based on our review of literature and our own experience, for the purpose of calculation of sample size in this study, the mean time to flatus was taken as 72 hrs+/−12 hrs. To detect a difference of 10 hrs in time to first flatus with a power of 90% and alpha of .05, sample size came to be 30 in each group. Statistical analysis was done using the Chi-square test for categorical variables and the student T-test for continuous variables. P value of <0.05 was considered significant.

Results

A total of one hundred patients were operated for GDPP in the study period, 18 patients were excluded as they were on ventilator in the postoperative period for more than six hours; 10 of these patients died. Eighty-two eligible patients were randomized into two groups, 39 patients received CG (study group) and 43 patients were in control group [Fig. 2]. Demographic details and JPS were comparable amongst both the groups; sensation of hunger (p value 0.0001), appearance of TFBS (p value 0.0001), TFF (p value 0.0001) and TFD (p value 0.0001) were significantly early in study group; LOHS was also shorter (p=0.001) in the study group (Table 1 and Figure 1). No adverse events related to CG were noted.

One patient in the study group and two patients in the control group developed transient leak from perforation site, which healed spontaneously in all three patients. One patient in the study group needed re-insertion of NG tube for two days on account of persisting nausea and bilious vomiting. There was no mortality in the included patients.

Discussion

In this prospective randomized control study of 82 patients operated for GDPP, the CG proved to be effective in reducing the duration of POI, as the appearance of TFBS, sensation of hunger, TFF and TFD were earlier in the study group as compared to control group; hospital stay was also significantly shorter.

POI is defined as a temporary inhibition of gastrointestinal motility after surgical intervention due to non-mechanical causes that prevents sufficient oral intake. [9] Prolonged ileus has been defined as persistence of these symptoms for more than 4 days after major abdominal surgery. [10] The mechanism of POI is believed to be due to activation of neuronal reflex pathways by inflammatory mediators and exacerbated by inflamed peritoneum, mesentery and bowel wall and bacterial toxins. Various risk factors for development of POI have been identified including increasing age, hypokalaemia, hypo-proteinemia, renal failure, peritoneal sepsis, American Society of Anesthesiologists scores 3 to 4, open approach,
operative difficulty, longer operative duration, bowel handling, drop in hematocrit or need for a transfusion, increasing crystalloid administration, intraoperative fluid overload and delayed mobilization. In its pathological form it can potentially result in increased nausea and vomiting, increased postoperative pain, pulmonary complications, poor wound healing, delayed oral intake, delay in postoperative mobilization, increased length of hospital stays (LOHS), increased resource use and healthcare costs. Hence, it merits attention of researchers.

CG in the postoperative period in a form of sham feeding improves POI has been known for quite some time. Its mechanism of action seems to originate in the action of chewing, which may act on cephalic-vagal stimulation of digestion, producing hormones associated with bowel motility, stimulating the motility of the duodenum, stomach, and rectum, or by stimulation of secretion of saliva, and pancreatic juices. Sorbitol and other hexitols present in CG may also play a role.

This has prompted its use in various studies over the last two decades; however their results have been somewhat mixed with a recent multicentre randomized clinical trial of 1000 elective abdominal surgery patients in each arm failed to show any benefit. A possible explanation was suggested that benefits had already been maximally optimized with the use of current Enhanced Recovery After Surgery (ERAS) protocol. On the other hand, many systematic reviews have concluded that CG’s use is a safe and effective intervention in reducing the incidence of POI. However, a Cochrane Database Systematic Review concluded that most of these studies primarily focussed on Caesarean Sections and Colorectal surgeries, and largely consisted of small, poor quality trials. They also cautioned that many other components of the ERAS programme also target ileus; therefore, the actual benefit of CG alongside ERAS may be difficult to evaluate. Another problem with interpretation of such studies are that these are quite heterogeneous, there is variable definition of POI ranging from 2 to 7 days by different authors; which leads to non-reproducibility of studies and difficulties in interpreting the results.

Success of ERAS protocols (minimally invasive surgery, goal-directed fluid management, opioid-sparing analgesia, early mobilization, early postoperative food intake, laxative administration, and omission/early removal of nasogastric tube, drains and catheter) in elective abdominal surgery settings led to their use in emergency settings; and was associated with favourable outcomes as indicated by reduced postoperative complications, accelerated recovery of bowel function and shorter post-operative hospital stay without increasing need for re-admission or re-operation. These benefits have been seen in many studies involving perforation peritonitis and intestinal obstruction and have now become part of guidelines.

To our knowledge, no study has been published till date to specifically assess the effects of CG in GDPP; although a multicentre randomised controlled trial has been registered recently. Our RCT was focussed on evaluating the sole effect of CG as none of the other steps of ERAS protocol were used in our study. It shows that CG can be beneficial even without using other parts of ERAS protocol; something a few treating surgeons may be reluctant to use in emergency surgery settings. Main limitation of our
study is small number of patients; hence larger multi-centric studies along with both with and without other steps of ERAS protocols are needed to assess the true advantages of CG.

**Conclusion**

Chewing gum is a safe and low-cost option for reducing the duration of post-operative ileus and thereby enhances recovery after surgery for Gastroduodenal perforation peritonitis.

**Declarations**

Competing interests: None

Grant/support/funding: No grants received for this research

Statement to comply with ethical requirements: Prior permission was obtained from institutional ethics committee (IEC/2020-23/3359 dated 13-12-2020)

Statement of informed consent: Informed consent was obtained from all participants included in the study

No violation of human and/or animal rights in this study

**Authors contribution declaration**

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Sanjay Muwel], and [Seema Suryavanshi] and [Hari Krishna Damde]. The first draft of the manuscript was written by [Arpan Mishra] and [Hari Krishna Damde] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

**References**


Tables

Table 1: Comparison of demographic profile and post-operative recovery, amongst study group and control group.
<table>
<thead>
<tr>
<th>Parameters</th>
<th>Study group No 39</th>
<th>Control group No 43</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean) years</td>
<td>42</td>
<td>48</td>
<td>0.26</td>
</tr>
<tr>
<td>Sex male/ female</td>
<td>36/3</td>
<td>36/7</td>
<td>-</td>
</tr>
<tr>
<td>Jabalpur Prognostic score (median)</td>
<td>7</td>
<td>7</td>
<td>0.95</td>
</tr>
<tr>
<td>Sensation of hunger mean (SD) hours</td>
<td>9.38 (1.3)</td>
<td>11.81 (1.8)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Time to first bowel sound mean (SD) hours</td>
<td>31.5 (2.5)</td>
<td>40.7 (3.7)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Time to first passage of flatus mean (SD) hours</td>
<td>52.3 (5.3)</td>
<td>68.14 (5.9)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Time to first passage of defecation mean (SD) hours</td>
<td>95 (4.9)</td>
<td>129 (11.5)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Length of hospital stay mean (SD) days</td>
<td>10 (2.6)</td>
<td>12 (2.1)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**Figures**
**Figure 1**

Box and whisker's plot showing comparison of sensation of hunger, appearance of bowel sounds, time to passage of flatus, and time to pass motion in hours from the surgery between study and control groups. Horizontal line indicates median. 25th-75th percentile and 5th-95th percentile are depicted by box and error bars respectively. Dots show outliers.
Figure 2

Flow chart of randomization scheme

100 consecutive operated patients of GDPP

18 patients excluded, as they were on ventilator for more than six hours.

82 patients randomised

39 Patients (Study group)

42 Patients (Control Group)