Postoperative Gum Chewing After Gynecologic Laparoscopic Surgery

A Randomized Controlled Trial

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OBJECTIVE: To investigate the effect of postoperative gum chewing on bowel motility after laparoscopic gynecologic surgery.

METHODS: In this randomized controlled trial, patients were allocated to either postoperative gum chewing every 2 hours for 15 minutes or standard postoperative care without gum chewing. The study's primary end points were time to first regular bowel sounds and time to first passage of flatus after surgery. Secondary end points were time of operation to first defecation, patient satisfaction concerning postoperative gum chewing, potential side effects of postoperative gum chewing, and potential effect of gum chewing on postoperative pain therapy.

RESULTS: One hundred seventy-nine patients were included in this trial. We found a significantly shorter interval between surgery and passage of first flatus in the intervention group compared with the control group (median 6.2 hours compared with 8.1 hours; $P=.002$) and a significantly higher rate of regular bowel sounds 3 hours (76% compared with 47%; $P<.001$) and 5 hours (91% compared with 78%; $P=.01$) after surgery. Fewer opioid analgetics were administered to patients allocated to the intervention group ($P=.02$). There was no significant difference in time to first defecation between groups (median 26.3 hours compared with 29.0 hours, $P=.165$). Gum chewing was well tolerated and well accepted by patients, and no intervention-related side effects were observed.

CONCLUSION: Gum chewing seems to have beneficial effects on bowel motility when used as an adjunct treatment in postoperative care after minimally invasive surgery. Gum chewing should be recommended to patients after gynecologic laparoscopic surgery.

CLINICAL TRIAL REGISTRATION: www.ClinicalTrials.gov, NCT 01549353.

(Obstet Gynecol 2013;122:85–90)

DOI: 10.1097/AOG.0b013e3182983e92

LEVEL OF EVIDENCE: I

Gum chewing has been reported to stimulate bowel motility after open abdominal surgery such as cesarean delivery,[1,2] liver resection[3] colorectal surgery,[4,5] and after laparoscopic surgery.[6,7] Gum chewing mimics food intake and is considered a kind of sham feeding. The physiologic mechanism for the enhanced recovery of bowel motility by gum chewing is assumed to be the activation of the cephalic–vagal pathway, which is stimulating intestinal myoelectric activity in an attempt to counteract activation of the gastrointestinal μ opioid receptors.[8] Sham feeding has been reported to stimulate motility of the human duodenum,[9] stomach,[10] and the rectosigmoid.[11] It also seems to increase the plasma concentration of the peptide hormone gastrin, the neuropeptide neurotensin, and that of pancreatic polypeptide.[10] In addition, sham feeding enhances duodenal alkaline secretion.[12] Therefore, gum chewing enhances bowel motility directly by cephalic–vagal pathway activation and indirectly by triggering the release of gastrointestinal hormones and increasing the secretion of saliva and pancreatic juice.[6]

Postoperative paralytic ileus is a common postoperative finding that can cause increased postoperative pain, patient discomfort, decreased postoperative mobility, decreased patient satisfaction, and prolonged hospital stay.[13] In general, after laparoscopic

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Financial Disclosure

The authors did not report any potential conflicts of interest.

ISSN: 0029-7844/13

surgery, problems with reduced bowel motility are not as common as after open surgery.[14,15] Animal studies have shown that the length and depth of the operative incision negatively influences bowel motility and transit.[16] It was consistently shown that laparoscopic colorectal procedures result in shorter duration of postoperative ileus than open procedures.[15,17]

As mentioned, gum chewing has been reported to have a beneficial influence on bowel motility for both open and laparoscopic surgery. However, until now, studies investigating the effect of postoperative gum chewing have been performed in laparoscopy involving bowel surgery only.[6,7]

The aim of this randomized controlled trial was to investigate the effect of postoperative gum chewing on bowel motility after minimally invasive gynecologic surgery without involvement of the bowel.

MATERIALS AND METHODS

This observer-blind, prospective, randomized controlled trial was performed at the Klinikum Klagenfurt am Woerthersee in collaboration with the Medical University Vienna, Vienna, Austria. The study was approved by the local institutional review board, Ethikkommission des Landes Kärnten (A02/10), and was registered with the clinical trials registry (ClinicalTrials.gov Identifier NCT 01549353).

All consecutive women who underwent laparoscopic surgery for benign gynecologic conditions under general anesthesia at our institution between July 2011 and August 2012 were invited to participate in this trial. Women between age 18 and 80 years were eligible for study inclusion. Patients with loose teeth and chronic obstipation were excluded. If the operation time was more than 3 hours or a laparotomy had to be performed, patients were also excluded from further analysis. We limited the length of surgery included in our study to 3 hours because a review of all laparoscopic surgeries performed at our institution 2 years before the study showed that nearly all cases lasting longer than 3 hours were either performed as a result of malignancy or serious intraoperative complications occurred. Patients in our study did not receive preoperative bowel preparation.

Eligible patients were invited to participate on the day of surgery by one of the research team members. The trial was explained and written informed consent was obtained. At this point, demographic data were noted and patients were allocated the next available number in the concealed sequence of a computer-generated randomization plan using one-to-one randomization. After surgery, the assigned intervention was revealed by the responsible nursing staff in the postoperative recovery room. All patients were asked to notify nursing or medical staff when first passage of flatus occurred. Patients in the chewing gum group started gum chewing every 2 hours for 15 minutes, beginning 2 hours postoperatively. A commercially available sugarless gum was used. The chewing gums were separately packed in a cellophane bag and stapled on a cardboard. A total of 10 chewing gums were stapled on each cardboard. Each chewing gum was numbered. Patients stopped gum chewing after first passage of flatus and returned the cardboard. Thereby patient compliance and the number of chewing gums used were captured. Patients assigned to the control group did not chew gum and standard postoperative care was provided. All patients were allowed to start oral intake of fluids and soft and solid foods when bowel sounds were first noticed, at the earliest 6 hours postoperatively. Two members of the research team checked for bowel sounds on each patient using a standard stethoscope every 2 hours beginning 3 hours postoperatively until first bowel sounds were noticed. Physicians who assessed the outcome parameters were blinded to the patients' group allocation. Observer blinding was achieved as a result of partition of gum chewing (starting 2 hours postoperatively, every 2 hours) and examination times (starting 3 hours postoperatively, every 2 hours). Furthermore, patients and nursing staff were educated to keep the group allocation secret. The cardboard including the chewing gum was at all times hidden from the research team (ie, placed in the patient's personal bedside locker).

All operations were performed under general anesthesia. Anesthesia was induced using propofol and maintained using sevoflurane. Rocuronium or atracurium was used as a muscle relaxant. None of the patients received concurrent epidural anesthesia. For postoperative analgesia, we used a standardized protocol. Patients received 100 mg ketoprofen intravenously on the day of surgery and per os or intravenously thereafter for a maximum of three doses per day. If adequate pain relief was not achieved using ketoprofen on the day of surgery, the patient received 7.5 mg piritramide intramuscularly. Pain was assessed using a visual analog scale. After the day of surgery, patients were treated with 100 mg ketoprofen intravenously if visual analog scale scores were 6 or greater and patients received 100 mg ketoprofen by mouth when visual analog scale scores were below 6.

Participants were followed until the fourth postoperative day. If patients were discharged from our department before the third postoperative day, they were interviewed by telephone. At the day of

discharge, patient satisfaction concerning postoperative gum chewing was assessed using a visual analog scale. Patients in the intervention group were asked to rate treatment satisfaction and if they would like to repeat postoperative gum chewing in case of another surgery. The lowest score was one reflecting maximal dissatisfaction and the highest score was 10 reflecting maximal satisfaction.

The study's primary end points were time to first regular postoperative borborygmus and time to first passage of flatus. The time at the end of the operation was defined as the 0 hour. Secondary end points were time of operation to first defecation, patient satisfaction concerning postoperative gum chewing, potential side effects of postoperative gum chewing, and potential effect of gum chewing on postoperative pain therapy using the synthetic opioid piritramide on the day of surgery.

Sample size calculation was based on a previous study performed in patients who underwent cesarean delivery.[1] Mean time of passage of flatus was assumed to be 24 hours and a mean difference of 6 hours was assumed to be of clinical relevance. Therefore, the mean time interval to passage of flatus after gum chewing was proposed to be 18 hours in the intervention group. Assuming that the common standard deviation is 12 hours, the sample size was calculated to be 85 participants for each arm applying $\alpha=0.05$ and 90% power.

Statistical analysis of the clinical trial was conducted according to the per-protocol principle using SPSS 16.0 software. Continuous variables are summarized as mean (±standard deviation) or median (range) and categorical data as percentages. Chi square, Fisher's exact test, Mann-Whitney *U* test, and binomial test were used accordingly. $P \leq .05$ was considered statistically significant.

RESULTS

Overall 189 patients were assessed for eligibility, of which nine declined to participate. Therefore, 180 women were included in this randomized controlled trial. One patient was excluded after randomization because she declined to chew gum more than one time. A total of 179 patients were included in final analysis (Fig. 1). The indications for surgery are listed in Table 1. Gum chewing was well tolerated and all patients included in final analysis completed their course of gum chewing until passage of first flatus. No adverse events such as choking or aspiration were observed in relation to gum chewing. None of the participants required reoperation or readmission after hospital discharge or blood transfusion. There was no

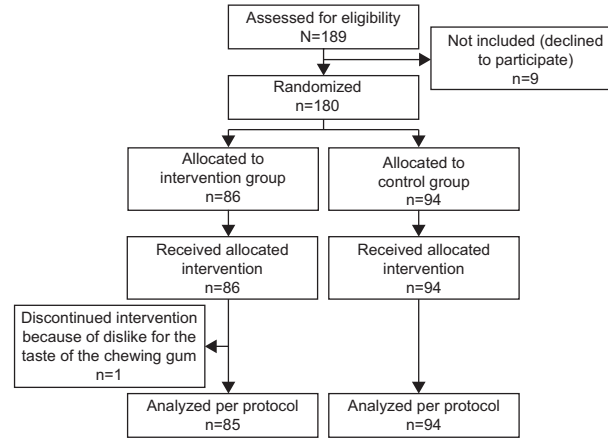

Fig. 1. Progress through the trial.

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case of symptomatic postoperative ileus. Patient characteristics of the intervention and control groups were comparable and did not differ with respect to body mass index, age, smoking history, duration of surgery, or length of hospitalization (Table 2). Complete data collection was achieved in all patients. A total of four patients (2.2%) were interviewed by telephone.

We found a significantly shorter interval between end of surgery and passage of first flatus in the intervention group compared with the control group (370 minutes [6.2 hours] compared with 483 minutes [8.1 hours]; $P=.002$ by Mann-Whitney test) and a significantly higher rate of regular bowel sounds after 3 hours (76% compared with 47%; $P<.001$ by Mann-

Table 1. Types of Surgery

Type of Surgery	Intervention Group (n=85)	Control Group (n=94)
Unilateral salpingo-oophorectomy or salpingectomy	13 (15.3)	12 (12.7)
Bilateral salpingo-oophorectomy	3 (3.5)	9 (10.4)
Total laparoscopic hysterectomy with or without bilateral salpingo-oophorectomy	10 (11.7)	9 (10.4)
Myomectomy	7 (8.2)	7 (7.4)
Unilateral or bilateral ovarian cystectomy	24 (28.2)	22 (23.4)
Diagnostic laparoscopy with or without removal of endometriosis	28 (32.9)	35 (37.2)

Data are n (%).

Table 2. Characteristics of Women Chewing Gum (intervention group) and Women Not Chewing Gum (control group) (n=179)

Characteristic	Intervention Group (n=85)	Control Group (n=94)	P*
Age (y)	40 (21–75)	42 (19–74)	.89
Body mass index (kg/m^2)	23.1 (17.8–36.6)	23.6 (16.1–38.2)	.68
Smoking history	32 (37)	35 (37)	.99
Duration of surgery (mo)	43 (10–149)	47 (10–162)	.54
Length of hospitalization (d)	3 (1–6)	3 (1–7)	.96

Data are median (range) or n (%) unless otherwise specified.
* Mann-Whitney *U* test or χ^2 test.

Whitney test) and 5 hours (91% compared with 78%; $P=.01$ by Mann-Whitney test) (Table 3). There was no significant difference between the intervention and control groups for the time of first postoperative mobilization ($P=.734$) of the patient and time to first defecation ($P=.165$) (Table 3).

Postoperative gum chewing resulted in high patient satisfaction illustrated by high visual analog scale scores (median 9.8, range 5–10). A total of 81 women (95%) out of 85 would repeat gum chewing after the next surgery, which was highly significant ($P<.001$; by binomial test). In the control group, 63 (67%) patients reported dry mouth in the postoperative period, whereas this was reported by only nine (10.5%) patients in the intervention group.

Furthermore, we tested the influence of postoperative gum chewing on the additional need of the synthetic opioid piritramide for postoperative analgesia on the day of surgery. In addition to ketoprofen routinely given to the patients on the day of surgery, one dose of intramuscular piritramide was administered in 23 patients (27%) in the chewing gum group compared with 27 (28.7%) patients in the control group, a second dose in two (2.3%) compared with 11 (11.7%) patients, and a third dose in none compared with two (2.1%) patients ($P=.64$, $P=.02$, and $P=.5$ by χ^2 or Fisher's exact test, respectively).

Table 3. Comparisons of Outcome Parameters Between Groups

	Intervention Group (n=85)	Control Group (n=94)	P*
First passage of flatus (h)	6.2 (1.8–30.6)	8.1 (2.2–30.4)	.002
Bowel sounds heard after 3 h	65 (76)	44 (47)	<.001
Bowel sounds heard after 5 h	77 (91)	73 (78)	.01
Bowel sounds heard after 7 h	84 (99)	88 (94)	.07
First postoperative patient mobilization (mo)	163 (75–530)	167 (78–277)	.73
First defecation (h)	26.3 (6.5–58.6)	29.0 (6.1–74.9)	.16

Data are median (range) or n (%) unless otherwise specified.
* Mann-Whitney *U* test or χ^2.

DISCUSSION

In this study, it was shown that postoperative gum chewing promotes bowel motility and reduces the need of postoperative opioid treatment after laparoscopic gynecologic surgery. First passage of flatus was significantly accelerated in the gum chewing group and a significantly higher rate of regular bowel sounds after 3 hours and 5 hours was observed (Table 3).

Our study prospectively investigated a high number of patients with minimally invasive gynecologic procedures. Randomization was effective, resulting in comparable groups with regard to known and presumably unknown confounders. We included women of all ages and different surgeries lasting between 10 and 162 minutes, making our results more generalizable. We believe that our findings are clinically relevant and important for minimally invasive gynecologic surgeons, because besides the beneficial effect of postoperative gum chewing, they show that gynecologic laparoscopies for benign indications place the patients at small risk for postoperative ileus with generally fast recovery of normal bowel motility and passage of first flatus.

Interestingly, this trial showed that after gynecologic laparoscopic surgery, with or without postoperative gum chewing, passage of first flatus seems to occur much faster than reported in laparoscopic surgeries involving the bowel or after open surgery. In laparoscopic colectomies, for example, passage of first flatus was reported to occur 48–72 hours postoperatively and after cesarean delivery 18–24 hours postoperatively.[1,6]

There are several potential explanations why passage of first flatus was faster in our cohort compared with previous reports. First, operation time in our cohort was very short in some cases (eg, 10 minutes). Second, Kalff et al[18] showed that the degree of ileus corresponds to intestinal inflammatory response. With increasing surgical manipulation of the bowel, there was a progressive decrease in muscle function. In gynecologic laparoscopic surgeries, however, the bowel itself is only minimally manipulated. The patient is typically placed in the modified dorsal

lithotomy and 20° to 30° of Trendelenburg position. This way the small bowel slips out of the operation field, mostly without the need for significant additional manipulation. The colon is almost never touched. Congenital attachments to the left pelvic wall sometimes need to be resolved, but this maneuver requires only minimal manipulation of the colon itself. Third, the amount of retroperitoneal dissection in gynecologic laparoscopic procedures for benign indications is small. The amount of retroperitoneal dissection, however, is significantly associated with colonic stasis.[19] For example, in a report of patients who underwent paraaortic lymph node dissection as a result of gynecologic malignancy, the incidence of postoperative ileus was 50%.[20]

It is current practice at our institution to mobilize patients as soon as possible after surgery. Patients in this trial were mobilized on average 3 hours postoperatively (Table 3). This might also have had a positive effect on return of regular bowel motility. Nevertheless, fast-track mobilization alone has not been shown to have a positive effect on bowel motility in previous studies.[21]

We further found that the need of postoperative opioid treatment was significantly less in the intervention group compared with the control group. This might be the result of less postoperative bloating and distension as a result of accelerated passage of first flatus. However, it could also be the result of distraction from postoperative pain caused by postoperative gum chewing. Several studies have indicated that distraction from a nociceptive stimulus can reduce pain perception.[22–24] Lastly, because the nature of the intervention did not allow blinding of the participants, it could be the result of a placebo effect. Nevertheless, we think that this is a significant finding, because opiate therapy leads to reduced bowel motility as a result of stimulation of κ and μ opioid receptors in the gastrointestinal tract, which in turn can lead to prolonged postoperative hospital stay[13,25]

We observed both improved bowel motility and reduced doses of opiates in the intervention group. It is not clear whether bowel motility was influenced directly by gum chewing or indirectly by reducing pain and the quantity of opiate use. However, we think that both reduced pain as well as improved bowel motility are clinically useful and improve postoperative comfort.

A potential limitation of our study is that the sample size calculation was based on a previous study performed in patients who underwent cesarean delivery.[1] At the time of study conception, we were not aware of any studies reporting the time to passage of first flatus in laparoscopic surgeries without involvement of the bowel. This potential shortcoming of our study needs to be kept in mind when interpreting our results. Nevertheless, our study revealed statistically significant results and therefore our trial was adequately powered to assess the study's primary end points.

In summary, this study shows that postoperative gum chewing enhances return of regular bowel motility after gynecologic laparoscopic surgery. This might be achieved directly by gum chewing or indirectly by reducing pain and the quantity of postoperative opiate use. Gum chewing is an inexpensive and physiologic intervention, which appears to be reasonably safe in the postoperative patients we studied. It was well tolerated in the early postoperative period and resulted in high patient satisfaction. Gum chewing seems to have beneficial effects when used as an adjunct treatment in postoperative care. Therefore, postoperative gum chewing should be recommended to patients after gynecologic laparoscopic surgery.

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