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ORIGINAL ARTICLE

Early oral diet may enhance recovery from benign gynecologic surgery: A single center prospective study

Szu-Ting Yang[a,b,c], Shu-Chen Kuo[d], Hung-Hsien Liu[e], Kuan-Min Huang[a], Chia-Hao Liu[a,b,c], Shu-Fen Chen[d,f,*], Peng-Hui Wang[a,b,c,g,*]

[a]Department of Obstetrics and Gynecology, Taipei Veterans General Hospital, Taipei, Taiwan, ROC; [b]Faculty of Medicine, School of Medicine, National Yang Ming Chiao Tung University, Taipei, Taiwan, ROC; [c]Institute of Clinical Medicine, National Yang Ming Chiao Tung University, Taipei, Taiwan, ROC; [d]Department of Nursing, Taipei Veterans General Hospital, Taipei, Taiwan, ROC; [e]Department of Medical Imaging and Intervention, Tucheng Hospital, New Taipei City, Taiwan, ROC; [f]Graduate Institute of Life Sciences, National Defense Medical Center, Taipei, Taiwan, ROC; [g]Female Cancer Foundation, Taipei, Taiwan, ROC

Abstract

Background: Early dietary intake enhanced recovery after surgery (ERAS). There remains a gap in the recognition and implementation of early diet after surgery in medical institutions in Taiwan. This study aimed to investigate whether early oral intake after benign gynecologic surgery results in favorable outcomes in Taiwanese patients.

Methods: This was a prospective controlled nonrandomized cohort study. Patients who underwent benign gynecological surgery were included in the early- and conventional-diet groups. The primary outcome was length of hospital stay, and the secondary outcome was postoperative complications.

Results: Forty and 38 patients were included in the early and conventional-diet groups, respectively. The early-diet group demonstrated significantly reduced length of hospital stay (the early-diet group, 2.58 ± 0.93 days; conventional-diet group, 4.16 ± 1.13 days; $p < 0.001$). No increase in postoperative complications was observed in the early-diet group. Laparoscopic surgery reduced the length of hospital stay (β, –0.65; 95% confidence interval [CI], –1.22 to –0.08; $p = 0.027$), while an increased length of hospital stay was associated with higher visual analog scales (VAS, β, 0.21; 95% CI, 0.03-0.39; $p = 0.026$) and the conventional-diet group (β, 1.13; 95% CI, 0.65-1.61; $p < 0.001$) as assessed by multivariate regression analysis.

Conclusion: Patients who underwent benign gynecologic surgery tolerated an early oral diet well without an increase in complications. Laparoscopic surgery and lower pain scores also enhanced postoperative recovery.

Keywords: Benign gynecologic surgery; Early oral feeding; Hospital stay

1. INTRODUCTION

Early diet intake is a component of enhanced recovery after surgery (ERAS) and has shown promising outcomes over the last decade.[1,2] However, in Taiwan, the concept of delayed food intake in the postoperative period remains deeply ingrained. Additionally, there is a discrepancy in the recognition and adoption of ERAS principles among healthcare professionals.[3] The reluctance to implement early-diet protocols may be attributed to concerns regarding complications related to feeding, such as nausea and vomiting. Traditionally, patients are permitted only clear fluid intake after flatus, followed by a gradual progression to full fluid, soft diet, and solid diet. Thus, there is an urgent need to provide evidence from our country to persuade practitioners and challenge the established workflows in hospitals in Taiwan.

This study aimed to investigate whether early oral intake after benign gynecologic surgery has favorable outcomes in Taiwanese patients. The primary outcome was length of hospital stay, and the secondary outcome was postoperative complications.

2. METHODS

2.1. Patients

This prospective, controlled, nonrandomized cohort study was conducted between January 2016 and September 2017. This study was approved by the Institutional Review Board of our institution. Detailed inclusion and exclusion criteria have been reported previously.[4,5] In brief, after obtaining patient consent, patients who underwent benign gynecologic surgery in the gynecologic department of our institution were eligible. All patients underwent transvaginal/transabdominal sonography before surgery to confirm the surgical indications.

* *Address correspondence: Dr. Peng-Hui Wang, Department of Obstetrics and Gynecology, Taipei Veterans General Hospital, 201, Section 2, Shi-Pai Road, Taipei 112, Taiwan, ROC. E-mail address: phwang@vghtpe.gov.tw, pongpongwang@gmail.com (P.-H. Wang); Dr. Shu-Fen Chen, Department of Nursing, Taipei Veterans General Hospital, 201, Section 2, Shi-Pai Road, Taipei 112, Taiwan, ROC. E-mail address: chensf@vghtpe.gov.tw (S.-F. Chen).*

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Indications for benign gynecologic surgery included myoma or adenomyoma/adenomyosis with menorrhagia or intolerable pain, enlarged uterus, adnexal lesions, and pelvic adhesions with symptoms. The exclusion criteria were as follows: age <20 years; previous bowel resection or anastomosis surgery (except appendectomy); and sepsis or septic shock before surgery.

2.2. Procedures

Before surgery, all patients were administered prophylactic antibiotics with a single dose of cefazolin. Clindamycin was administered if a patient was allergic to cephalosporins. Two surgeons (Dr. A and Dr. B) were involved in the study and both had at least 20 years of experience in the independent practice of surgery. The patients underwent laparotomy or laparoscopic surgery based on their willingness after shared decision-making (SDM), which is a well-accepted agreement between family, patients, and health providers.[6] The surgeons explained the details of laparotomy or laparoscopic surgery and the advantages and risks, including the general principle of surgery and basic risks of either the laparoscopic approach or exploratory laparotomic approach. For example, laparotomy surgery has advantages, such as direct touch and complete visualization of the surgical field without the presence of time lag, and of importance, being applicable to all surgeries while still remaining cost-effective. However, laparotomy requires a large incision and is associated with wound-related morbidities, such as wound pain.[7,8] For laparoscopic surgery, which is minimally invasive[9–11] compared with conventional exploratory surgery, the advantages include smaller wounds with cosmetic benefits, less wound infection risk, and less postoperative pain; however, some minimally invasive approach-related adverse events, such as gas embolism, emphysema, and surgical positioning– or instrument-related complications, among others may occur.[12] Finally, the patients also expressed their preferences and beliefs, and SDM was performed after comprehensive discussions between surgeons and patients. All surgeries were performed under general anesthesia. The peritoneal adhesion index (PAI) score, ranging from 0 to 30, was recorded during surgery.[13] The patients were assigned to either the study group (early diet) or the control group (conventional diet) based on the surgeon's preference (Dr. A's preference for early diet and Dr. B's preference for conventional diet). An early diet was defined as the permission to have an oral intake of solid food upon departure from the operating room, irrespective of the presence or absence of flatus or stool passage. Patients on conventional diets were only allowed solid food intake after flatus.

2.3. Parameters

Ear temperature higher than 38°C was referred to as a fever. A visual analog scale (VAS) was used for pain evaluation.[14,15] Based on our previous experience, the highest VAS score occurred in the period between 12 and 24 hours postoperatively. Data were recorded.[16] The dosage of intravenous painkillers was recorded, and the total equivalent morphine dose was calculated during hospitalization. The time to flatus was defined as the time from the day of surgery to the day of a patient-reported flatus event. Oral painkillers, such as nonsteroidal anti-inflammatory drugs (NSAIDs) or acetaminophen, were prescribed to all patients. Antiemetic drugs include intramuscular prochlorperazine and intravenous metoclopramide. If patients had postoperative ileus, they were treated with temporary restriction of food and fluids by mouth, intravenous fluid support, nasogastric tube drainage, and Evac enema, if needed. Any event of unplanned reoperation or readmission 30 days after surgery was recorded.

2.4. Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 24 (IBM Corp., Armonk, NY, USA). Descriptive statistics are presented as mean ± SD or percentages. Continuous variables were compared using independent *t* tests. Categorical variables were compared using chi-square or Fisher's exact tests. Age, adhesion status, and surgical history may affect the length of hospital stay. A subgroup analysis was conducted based on these three items. Univariate and multivariate linear regression analyses were used to evaluate the associations between the variables. Multivariate linear regression analysis was performed after adjustments. Statistical significance was set at $p < 0.05$.

3. RESULTS

Our analysis included 78 women: 40 in the early-diet group and 38 in the conventional-diet group. The mean age, body mass index, parity, type of surgery (laparotomy or laparoscopy), operative time, and previous abdominal surgery were similar between the two groups (Table 1). In the early-diet group, more patients were diagnosed with adnexal lesions or pelvic adhesions. More patients in the early-diet group underwent partial or total laparoscopic adnexal excisions. The PAI was significantly higher in the early diet group (3.93 ± 2.88 vs 1.18 ± 1.75, $p < 0.001$) (Table 1).

The number of fever events did not differ significantly between the two groups. However, no fever events occurred in the early-diet group (0 [0%] vs 3 [7.9%], $p = 0.111$). The VAS score was significantly lower in the early-diet group (3.48 ± 1.11 vs 4.34 ± 1.21, $p = 0.001$). Antiemetic drug use was lower in the early-diet group (0.03 ± 0.16 vs 0.26 ± 0.45, $p = 0.003$). The average length of the hospital stay was 2.58 ± 0.93 and 4.16 ± 1.13 days for the early- and conventional-diet groups, respectively, and the difference was statistically significant ($p < 0.001$; Table 2). The median time of flatus was on postoperative day 1.37 ± 0.714 in the conventional-diet group. Patients in the early-diet group were discharged, regardless of flatus occurrence during hospitalization. Thus, we could not record the timing of flatus in the early-diet group, because some patients experienced flatus after discharge. The median time to oral diet was on postoperative day 1.76 ± 0.79 in the conventional-diet group. All patients in the early-diet group received an oral diet on the same day as the operation.

Table 3 presents the results of the subgroup analysis according to age, adhesion status, and history of abdominal surgery. The participants were divided into younger and older age groups with a cutoff age of 39 years, which was the mean age of this cohort. With the same method, the PAI score was classified as ≧3 and <3 points. Regardless of age, adhesion status, and surgical history, the subgroup analysis revealed consistently longer hospital stays in the conventional-diet group.

Table 4 presents the predictor coefficients and corresponding 95% confidence intervals (CI) for the univariate and multivariate analyses. Univariate linear regression analysis indicated that a diagnosis of adnexal lesions or pelvic adhesions and laparoscopic surgery were associated with a shorter hospital stay. Patients with higher VAS scores, more antiemetic use, and a conventional diet had longer hospital stays. Multivariate linear regression analysis using the enter method was adjusted for age, diagnosis, type of surgery, VAS score, antiemetic dose, and dietary mode. In the multivariate linear regression analysis, only the diagnosis of the lesion, type of surgery, VAS score, and diet mode had an impact on hospital stay. Diagnosis of an adnexal lesion or pelvic adhesion (β, –0.60; 95% CI, –1.11 to –0.09; $p = 0.023$) and laparoscopic surgery (β, –0.65; 95% CI, –1.22 to –0.08; $p = 0.027$) were significantly associated with a shorter hospital stay. For a one-point increase in the VAS score, the length of hospital stay increased by 0.21 days (β, 0.21; 95%

Table 1

Differences in characteristics between participants receiving early and conventional diet

	Early diet (40)	Conventional diet (38)	*p*
Age	38.10 ± 12.56	39.87 ± 9.22	0.482
Body mass index	22.65 ± 4.40	23.18 ± 3.32	0.550
Parity	0.93 ± 1.16	0.82 ± 0.98	0.656
Diagnosis			
Myoma	9 (22.5%)	21 (55.3%)	0.003
Adnexa lesion or pelvic adhesion	31 (77.5%)	17 (44.7%)	
Type of surgery			
Laparotomy myomectomy	3 (7.5%)	5 (13.2%)	0.040
Laparotomy adnexal partial or total excision	4 (10.0%)	2 (5.3%)	
Laparoscopic-assisted hysterectomy	7 (17.5%)	9 (23.7%)	
Laparoscopic adnexal partial or total excision	25 (62.5%)	13 (34.2%)	
Laparoscopic myomectomy	1 (2.5%)	7 (18.4%)	
Laparoscopic adhesion lysis	0 (0%)	2 (5.3%)	
Type of surgery (laparotomy or laparoscopy)			
Laparotomy	7 (17.5%)	7 (18.4%)	0.574
Laparoscopy	33 (82.5%)	31 (81.6%)	
Operation time, min	93.35 ± 42.37	105.18 ± 37.89	0.198
PAI score	3.93 ± 2.88	1.18 ± 1.75	<0.001
Previous abdominal surgery	13 (32.5%)	9 (23.7%)	0.270

PAI = peritoneal adhesion index.

Table 2

Differences in outcomes for participants receiving early and conventional diet

	Early diet (40)	Conventional diet (38)	*p*
Fever	0 (0%)	3 (7.9%)	0.111
VAS score	3.48 ± 1.11	4.34 ± 1.21	0.001
Equivalent total morphine dose, mg	23.58 ± 11.03	22.34 ± 10.86	0.621
Antiemetic dose	0.03 ± 0.16	0.26 ± 0.45	0.003
Length of hospital stay, d	2.58 ± 0.93	4.16 ± 1.13	<0.001

VAS = visual analog scales.

Table 3

Subgroup analysis for the length of hospital stays according to age, adhesion status, and abdominal surgery history

The length of hospital stays, d	Early diet (40)	Conventional diet (38)	*p*
Age			
>39	2.82 ± 1.13	4.41 ± 1.14	<0.001
≦39	2.39 ± 0.72	3.81 ± 1.05	<0.001
PAI score			
≧3	2.80 ± 1.04	4.20 ± 1.30	0.072
<3	2.20 ± 0.56	4.15 ± 1.12	<0.001
Abdominal surgery history			
Yes	2.54 ± 0.88	4.56 ± 1.01	<0.001
No	2.59 ± 0.97	4.03 ± 1.15	<0.001

PAI = peritoneal adhesion index.

CI, 0.03-0.39; $p = 0.026$). Conventional diet was significantly associated with longer hospital stays (β, 1.13; 95% CI, 0.65-1.61; $p < 0.001$). There were no events of postoperative ileus, postoperative nasogastric tube insertion, postoperative evacuation enema, unplanned reoperation, or readmission 30 days postoperatively in both groups.

4. DISCUSSION

The findings of this study suggest that early oral solid food intake is associated with shorter hospital stay. Importantly, early diet did not increase adverse outcomes. Additionally, a lower postoperative VAS score was associated with a shorter length of hospital stay. This implies a need for adequate postoperative pain control. Laparoscopic surgery and surgical indications, including adnexal masses, regardless of adhesions, also resulted in shorter hospital stays.

The key point for successful and speedy recovery after surgery is the resumption of gastrointestinal motility. Surgery affects gastrointestinal movements through multiple mechanisms. Macrophages release chemokines and cytokines to induce inflammation in intestinal muscles in response to surgical stress.

Table 4

Linear regression analysis for the length of hospital stays

	Univariate regression analysis		Multivariate regression analysis	
	β (95% CI)	*p*	β (95% CI)	*p*
Age, y	0.03 (0.000-0.053)	0.048	0.01 (–0.01 to 0.03)	0.212
Diagnosis				
Uterine mass	Reference value		Reference value	
Adnexal lesion or pelvic adhesion	–1.33 (–1.86 to –0.81)	<0.001	–0.60 (–1.11 to –0.09)	0.023
Type of surgery				
Laparotomy	Reference value		Reference value	
Laparoscopy	–0.80 (–1.54 to –0.05)	0.037	–0.65 (–1.22 to –0.08)	0.027
PAI score	–0.07 (–0.18 to 0.04)	0.193		
VAS score	0.39 (0.17-0.61)	0.001	0.21 (0.03-0.39)	0.026
Antiemetic dose	1.40 (0.61-2.18)	0.001	0.22 (–0.46 to 0.90)	0.52
Diet mode				
Early diet	Reference value		Reference value	
Conventional diet	1.58 (1.12-2.05)	<0.001	1.13 (0.65-1.61)	<0.001

CI = confidence interval; PAI = peritoneal adhesion index; VAS = visual analog scales.

The manipulation of internal organs and damaged tissues is also attributed to intestinal inflammation. Mast cells eliminate bacteria by releasing vasoactive mediators to increase mucosal permeability, allowing bacteria to enter the lymphatic duct.[17] Moreover, the normal basal electrical activity of the gastrointestinal tract is interrupted after surgery. Gastrointestinal motility can be divided into fed and fasting phases. In the fed phase, irregular gastrointestinal contractions of different intensities and durations were observed. During fasting, the migrating motor complex (MMC) maintains cyclic, strong, and regular contractions in the stomach and the small bowel. If the patient fasted after the surgical procedure, only MMC activity was observed without normal feed-phase bowel activity. Furthermore, anesthetic agents, incision peritoneum, and surgical manipulation of the intestines also impair MMC activity.[18] Therefore, early enteral nutrition is theoretically beneficial for restoring enteral reflux and motility. In addition, food intake may enhance the secretion of certain gastrointestinal hormones, such as cholecystokinin (CCK) and motilin, that simulate gastrointestinal motility.[19,20]

The process of "early diet" was defined differently in the previous research. Steed et al[21] conducted a randomized controlled trial to evaluate tolerance to an early diet in major gynecological surgery. Early diet was defined as at least 500 mL of clear fluid on the first postoperative day and then progressing to a solid diet thereafter. It took a median of 2 days after surgery when the patients could tolerate a solid diet.[21] Balayla et al[22] started a clear liquid diet 6 hours after surgery and then tried a solid diet. Macmillan et al[23] demonstrated that patients could tolerate a low-residue diet within 6 hours of arrival in the ward after gynecologic surgery. The recent trend in the ERAS protocol is to encourage solid food in the first 24 hours after gynecologic surgery, even when combined with colon or intestinal resection surgery.[24–26] Our early-diet protocol is consistent with the current recommendations. When patients present with persistent vomiting, despite the use of antiemetics, and acute abdomen, discontinuation of the early-diet protocol was considered in our study; however, all 40 patients in the early-diet group tolerated the early-diet protocol.

In addition to accelerating bowel movement resumption, early diet has several advantages. Balanced postoperative nutrition status relying on adequate enteral intake is important for wound healing.[27,28] Minig et al[29] demonstrated that the traditional diet protocol was associated with a higher wound infection and wound dehiscence rate in patients who underwent gynecologic oncology surgery. Among patients receiving gynecologic oncology surgery with intestinal resection, early-diet protocol still reduced wound infection incidence.[30] The traditional oral feeding protocol is associated with infectious complications, including abdominal abscess, urinary tract infection, and pneumonia.[31] Early initiation of enteral feeding has a positive impact on the regeneration of mucosal villi, thus diminishing bacterial translocation and consequently abdominal abscess.[21,29,31] Moreover, early oral intake has a positive influence on the patient's mood and satisfaction.[29] Patients are concerned about the progress of recovery and may experience nervousness and compromised well-being if they did not recover in a timely manner.[32] Moreover, the patient may experience stress due to guilt related to longer hospital stays and the increased need for help from family members. From an economic perspective, an early feeding protocol leading to shortened hospital stays is beneficial for government cost savings and avoids an overwhelm healthcare system.

Apart from early diet, we found some factors that facilitated the reduction in hospital stay. First, a lower VAS score was associated with a shorter length of hospital stay. A lower VAS score may result from adequate postoperative pain control or minimally invasive surgery.[1] Inadequate pain control results in numerous biological and psychological complications such as immobilization, delayed oral feeding, delayed Foley catheter removal, pneumonia, urinary tract infection, deep vein thrombosis, low mood, anxiety, and consequently prolonged recovery time.[4,5,33] Second, minimally invasive surgery is a part of the ERAS protocol.[34–40] Our multivariate regression analysis results also validated the positive impact of laparoscopic surgery on the length of hospital stay.

This study has several strengths. To the best of our knowledge, this is the first study to investigate an early feeding protocol for benign gynecological surgery in Taiwan. Feeding protocols vary according to country, culture, and healthcare facility. Early dietary protocols have not yet been fully implemented in Taiwan. Our results present compelling data to convince gynecologic clinicians and patients in Taiwan. Second, two experienced surgeons performed all the surgeries at our institute. This may have diminished the bias in non-uniform surgical techniques between surgeons. Finally, we found that some independent factors, such as laparoscopic surgery and lower VAS scores, were related to reduced hospital stay. Minimally invasive surgery,[2,8] including robotic surgery,[9,10] natural orifice surgery,[35,36,38] and laparoscopic surgery,[12,35,37–39] has become increasingly popular in recent decades, although some controversial issues remain.[41]

Additionally, adequate pain control is the milestone for successful surgical treatment and should always be applied.[42] As such, these aforementioned factors are also part of the ERAS protocol.

The present study has some limitations. First, the sample size is relatively small. Second, the patients were assigned to an early-diet group or a conventional-diet group based on the preferences of the two surgeons (Dr. A and Dr. B). However, the inclusion of only two surgeons with more than 20 years of experience may minimize bias from different surgeons. However, the fundamental bias cannot be ignored. Third, there were more cases of laparoscopic adnexal surgery in the early-diet group, which may have influenced the outcomes. Multivariate analysis took this into consideration and included the diagnosis and type of surgery in the adjustment process. The diet mode remained a significant prognostic factor after adjusting for multivariate analysis. Furthermore, we only included patients undergoing benign gynecologic surgeries. Although ERAS also piqued the major interest in studying the feasibility and safety of gynecologic oncology surgery.[43] In line with this, in future, our research would aim to investigate the effect of early diet in gynecologic oncology surgeries.

In conclusion, our study demonstrated that early postoperative feeding was well-tolerated by patients undergoing benign gynecological surgery, with no increase in complications. Furthermore, early feeding was associated with a shorter length of hospital. Additionally, we observed that minimally invasive surgery and lower pain scores were linked to a reduced length of hospital stay. The successful implementation of various techniques to accelerate postoperative recovery from surgery is crucial in improving patient outcomes.

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