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The effect of video-assisted education on postoperative outcomes after laparoscopic cholecystectomy: A randomized controlled trial

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ABSTRACT

Objective: To determine the effects of video-assisted education on postoperative physiological parameters and recovery outcomes of patients undergoing laparoscopic cholecystectomy.
Background: Laparoscopic cholecystectomy is a widely used minimally invasive surgical method to treat gallstones. Effective preoperative education is critical to enhance postoperative recovery and reduce complications.
Design: A randomized controlled trial.
Methods: This study was conducted between October 1, 2023, and January 17, 2024, in the General Surgery Department of a public state hospital in Turkey. A total of 92 patients were randomly assigned to the intervention (n = 46) and control (n = 46) groups. The intervention group received video-assisted education, whereas the control group received the same content through a brochure. Educational content included information about postoperative pain, nausea–vomiting management, nutrition, early mobilization, fluid intake, wound care, bathing, and follow-up instructions. Data were collected using a sociodemographic form, Visual Analog Scale (VAS), pre/postoperative patient assessment form, and a dietary habits questionnaire. Primary outcome was bowel recovery, assessed as the presence of defecation on the follow-up day (postoperative day 5–7). Secondary outcomes included nausea/vomiting at discharge, pain intensity (VAS), bathing related support needes for assistance, vital signs/physiological parameters, mobilization, and dietary habits.
Results: Vital signs remained stable in both groups, with no significant intergroup differences. Defecation at follow-up was more common in the intervention group ($p < 0.001$). Vomiting at discharge was lower in the intervention group ($p < 0.05$). Bathing-related support needs differed between groups at follow-up ($p = 0.001$).
Innovation: This study integrates standardized video-based education into perioperative nursing care and evaluates functional recovery indicators alongside physiological measures.
Conclusion: Video-assisted education was more effective than brochure-based education in promoting bowel recovery after laparoscopic cholecystectomy, while effects on other outcomes may vary by clinical context. Combining written materials with standardized video content may further enhance patient education in perioperative care.

1. Introduction

Gallstones formed by the precipitation of cholesterol, bilirubin, bile salts, and phospholipids in bile may become symptomatic when they obstruct biliary flow [1]. Management options include bile acid dissolution or surgery. Technological advances have made laparoscopic cholecystectomy the preferred approach, offering shorter recovery and hospital stays, less tissue trauma, and fewer complications than open surgery [2-6].

However, postoperative pain is common after laparoscopic cholecystectomy because CO_2 insufflation can irritate the diaphragm, causing shoulder pain, respiratory discomfort, and somatic pain from trocar trauma [7,8]. Inadequate pain control can result in shallow breathing, hypoxia, and delayed mobilization. Postoperative anesthetic-related

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nausea and vomiting can delay oral intake, contribute to dehydration and electrolyte disturbances, and impede recovery [9,10]. Surgical site infection is another possible complication that can be prevented through early diagnosis and appropriate management [11]. Therefore, combined pharmacological and non-pharmacological pain management strategies are recommended [12,13].

Maintaining stable physiological parameters postoperatively is crucial for early detection and management of complications. Patient education is a key nursing intervention that supports physiological stability [14]. Educational methods supported by audiovisual materials such as videos can facilitate learning, reduce anxiety, and improve self-care ability [4,15]. Patients receiving effective preoperative education often demonstrate earlier mobilization, fewer complications, and more stable recovery [16,17]. Additionally, tailoring educational materials to individual patient needs and ensuring clarity can enhance satisfaction and adherence and reduce rehospitalization [18]. Video-based instructions significantly reduce anxiety in patients undergoing endoscopy, cardiac surgery, and coronary angiography, emphasizing the role of video education in increasing comprehension and comfort [19-21].

However, reliability of visual educational materials remains a concern. Rodriguez et al. [22] assessed the top-10 laparoscopic cholecystectomy videos on YouTube and found that only one included a proper critical view of safety, whereas half contained serious surgical errors. This raises concerns regarding the use of unverified online content. Since platforms such as YouTube sort videos by popularity rather than clinical validity, educational interventions must rely on high-quality peer-reviewed content to ensure safety and accuracy. Recent evidence also highlights the importance of evaluating not only physiological outcomes but also functional recovery indicators in surgical patients, such as early mobilization, defecation, and independent bathing, as they are directly associated with patient autonomy and discharge readiness. Studies on enhanced recovery after surgery (ERAS) protocols have shown that laparoscopic approaches, when combined with structured preoperative education, contribute to better outcomes in functional domains, including pain control, nausea, mobility confidence, and self-care activities such as dressing and bathing [23-25]. However, the extent to which different educational modalities, particularly video-assisted versus brochure-based instructions, affect functional recovery parameters remains underexplored.

Existing studies primarily focused on either physiological parameters or patient anxiety, with limited attention paid to functional recovery indicators such as bowel function, bathing independence, or early mobilization. Additionally, there is lack of randomized controlled trials that directly compare video- and brochure-based educational methods in the context of laparoscopic cholecystectomy. To address this gap, we conducted a randomized controlled trial to investigate the effects of video-assisted education on key postoperative functional outcomes in addition to physiological parameters. The following hypotheses were tested:

H1. Video-assisted education increases the likelihood of early gastrointestinal recovery (e.g., defecation frequency) by the follow-up day in patients undergoing laparoscopic cholecystectomy compared to brochure-based education.

H2. Video-assisted education reduces the incidence of postoperative nausea and vomiting on the discharge day.

H3. Video-assisted education improves functional recovery indicators (e.g., bathing-related support needs and mobilization) on the follow-up day.

H4. There are no significant differences between video-assisted and brochure-based education in terms of vital signs (e.g., heart rate, blood pressure, temperature, and respiratory rate) on discharge and follow-up days.

2. Materials and methods

2.1. Study design and participants

A single-center, randomized controlled trial designed in accordance with the CONSORT 2010 guidelines (Table S1) was conducted in the General Surgery Department of a public state hospital in Turkey between October 1, 2023, and January 17, 2024. The effectiveness of the training intervention was assessed by comparing the results of the experimental and control groups. The independent variable was the educational method (video-assisted vs. brochure-based). Dependent variables included postoperative physiological parameters (e.g., pain, nausea/vomiting, vital signs) and functional recovery indicators after discharge. The primary outcome was bowel recovery, assessed as defecation on the follow-up day (postoperative day 5–7). Secondary outcomes included nausea/vomiting at discharge, pain intensity (VAS), bathing-related support needs, vital signs/physiological parameters, mobilization, and dietary habits.

Based on repeated-measures power analysis (G*Power 3.1.9.6) with a significance level of $p = 0.05$ and a statistical power of 85%, the required sample size was calculated to be 92 patients (46 each in the experimental and control groups). After excluding patients with impaired consciousness, speech difficulties, hearing impairment, or diagnosed psychiatric conditions, 92 participants were randomized equally into two parallel groups using the Random Sample function of a computer program. Allocation concealment was maintained using sequentially numbered, opaque, sealed envelopes, which were prepared by a researcher not involved in participant enrollment or assessment. The envelopes were opened only after participants' inclusion in the study was confirmed. Owing to the nature of the educational intervention, blinding of participants and healthcare providers was not feasible. However, the researcher who evaluated the postoperative outcomes was blinded to group allocation to minimize observer bias. Of the 96 enrolled participants, four were excluded because of cancellation of surgery (2), refusal to continue participation (1), or incomplete data collection (1). An intention-to-treat approach was applied, and missing data were excluded list-wise during the analysis because of their minimal proportion (<5%).

The experimental group received structured video-assisted education, whereas the control group received the same educational content in brochure format. The standardized education covered postoperative pain and nausea-vomiting management, nutrition, early mobilization, adequate fluid intake, wound care, bathing, and follow-up instructions. Outcomes were assessed at predefined time points: preoperative baseline, hospital discharge (within 24 h after surgery), and the follow-up day (postoperative day 5–7). Fig. 1 shows the CONSORT flow diagram of the study. (See Table 1.)

2.2. Data collection

Data were collected through face-to-face interviews and telephone follow-ups. In the experimental group, the video was delivered preoperatively by a trained nurse and participants also received the brochure as take-home reinforcement. In the control group, participants received the brochure (with standard verbal clarification as needed). The data collection process took approximately 20–30 min for each group, and the education sessions lasted 30–40 min.

Four tools were used for the data collection. (1) Patient Identification Form, which recorded the participants' sociodemographic and medical history, including age, sex, marital status, educational level, previous surgeries, and chronic illnesses. (2) Visual Analogue Scale for pain assessment, a widely used method for evaluating pain intensity, particularly for patients who may have difficulty verbally expressing their discomfort. In this scale, a straight numerical line ranging from 0 (no pain) to 10 (worst imaginable pain) was presented to the patient who was asked to indicate the point corresponding to their perceived

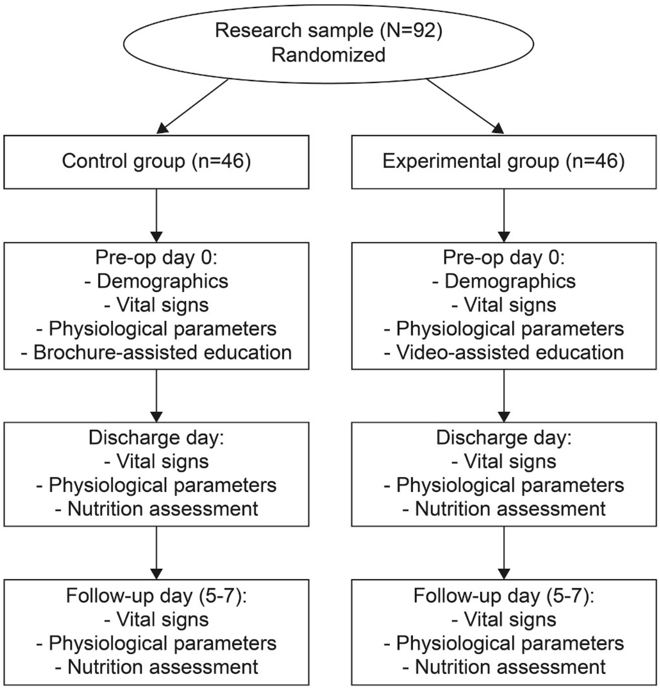

Fig. 1. CONSORT flow diagram.

pain level, and the distance from the "no pain" end to the marked point was measured to determine pain severity. (3) Pre- and Postoperative Patient Assessment Form used to evaluate physiological parameters, such as body temperature, pulse, blood pressure, blood glucose level, defecation status, respiratory rate, nausea, vomiting, pain score, presence of infection (including redness, discharge, or edema), method of discharge (walking or wheelchair), daily walking duration (indoor or outdoor), ability to climb stairs, and bathing status. (4) Post-Cholecystectomy Nutrition Assessment Form, which assessed dietary habits after surgery, including the types of food consumed (liquid only, solid only, or both) as well as the intake of fatty foods, fruits and vegetables, sugary foods, dairy products, eggs, white meat, red meat, and any dietary restrictions.

2.3. Data analysis

Statistical analyses were conducted using SPSS version 25.0. Categorical variables are presented as n (%), and continuous variables as mean ± SD or median (min–max), as appropriate. Normality was assessed with the Shapiro–Wilk test. Between-group comparisons at each time point (preoperative, discharge, and follow-up) were performed using the independent-samples *t*-test for normally distributed data and nonparametric alternatives otherwise; categorical variables were compared using the chi-square test. Effect sizes were calculated using Cohen's d for continuous outcomes and Cramér's V for categorical comparisons. A *p*-value <0.05 was considered statistically significant.

2.4. Ethical considerations

Ethical approval was obtained from the Gaziantep Provincial Health Directorate and Izmir Tınaztepe University Clinical Research Ethics Committee prior to commencing the study (Approval Date: September 14, 2022; Approval No.: 07). This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. All participants provided written informed consent after being informed of the purpose and scope of the study.

Table 1
Demographic characteristics of participants ($n = 92$).

Variable	Number (n)	Percentage (%)
Age		
15–30	16	17.4
30–60	69	75
60–90	7	7.6
Gender		
Women	60	65.2
Men	32	34.8
Marital status		
Married	88	95.7
Single	4	4.3
Number of children		
0–5	63	68.5
5–10	27	29.3
10–15	2	2.2
Educational background		
Literate	4	4.3
Primary	59	64.1
High school	12	13.0
License	2	2.2
Illiterate	15	16.3
Body mass index		
15–18.5	1	1.1
18.6–24.9	14	15.2
25–29.9	37	40.2
30–34.9	28	30.4
35–39.9	12	13.0
Profession		
Worker	19	20.7
Housewife	60	65.2
Self–employment	3	3.3
Civil servant	3	3.3
Retired	7	7.6
Chronic disease		
Yes	30	32.6
No	62	67.4
Familial illness		
Yes	45	48.9
No	47	51.1
Previous operation		
Yes	44	47.8
No	48	52.2
Smoking/alcohol habit		
Yes	19	20.7
No	73	79.3

2.5. Trial registration

This randomized controlled trial was retrospectively registered at ClinicalTrials.gov (Identifier: NCT07277036) and first posted/released on 28 November 2025.

3. Results

Most participants were aged 30–60 years (75.0%), women (65.2%), married (95.7%), had 0–5 children (68.5%), and had completed only primary education (64.1%). Over 70% of the participants fell within the overweight and obese ranges (25.0–34.9 kg/m^2). A substantial proportion were housewives (65.2%), with the remainder being workers, retirees, civil servants, or self-employed individuals. Regarding health, 32.6% of the patients reported at least one chronic disease, and 48.9% had a family history of chronic illness. Previous surgical experience was reported by 47.8% of the participants. Additionally, 20.7% of the respondents acknowledged current or past tobacco or alcohol use.

Overall, the groups were comparable at baseline for most demographic and clinical characteristics. Specifically, there were no statistically significant differences in age, marital status, number of children, educational background, body mass index, employment status, chronic disease, and smoking or alcohol use ($p > 0.05$). However, statistically significant differences were observed in sex ($p = 0.008$), family history of illness ($p = 0.007$), and previous surgical history ($p = 0.012$) (Table S2). These variables were considered when interpreting the outcomes.

Measurements obtained preoperatively and on the discharge and follow-up days show that the patients' mean body temperature, pulse rate, systolic and diastolic blood pressures, blood glucose levels, and oxygen saturation (SpO_2) values remained comparable across assessments (Table S3).

Preoperatively, there were significant differences between the experimental and control groups in body temperature ($p < 0.001$), blood glucose ($p = 0.007$), and SpO_2 levels ($p = 0.033$). On the day of discharge, a significant difference was observed only in the body temperature ($p = 0.034$). No statistically significant differences were detected between the groups in follow-up and delta (Δ) vital sign values ($p > 0.05$) (Table 2).

As illustrated in Fig. 2, Cohen's d values indicate varying magnitudes of effects across physiological parameters. The strongest effects were observed in preoperative temperature (d = −0.82, large), preoperative glucose (d = −0.60, medium), and SpO_2 changes (d = −0.35, small to medium). These findings suggest that video-assisted education has a significant effect on these parameters. However, differences in discharge SpO_2 and follow-up heart rate (d = −0.3) were in the small effect range, while follow-up diastolic blood pressure and glucose variation (d = −0.15 to −0.18) reflected negligible effects.

Table 2
Group mean and statistical comparisons of vital signs.

	Experiment (n = 46)	Control (n = 46)	t	p
	Mean ± SD	Mean ± SD		
Preoperative				
Fever (°C)	36.3 ± 0.2	36.5 ± 0.3	−3.723	<0.001**
Heart rate (min)	80.0 ± 7.9	79.1 ± 7.1	0.570	0.570
Systolic TA (mmHg)	124.8 ± 6.6	122.8 ± 6.2	1.467	0.146
Diastolic TA (mmHg)	66.9 ± 6.6	68.9 ± 7.4	−1.339	0.184
Blood glucose (mg/dL)	95.2 ± 6.6	99.6 ± 8.5	−2.784	0.007**
SPO_2 (%)	97.3 ± 1.9	98.0 ± 1.5	−2.164	0.033*
Discharge day				
Fever (°C)	36.3 ± 0.4	36.5 ± 0.3	−2.153	0.034*
Heart rate (min)	79.0 ± 12.2	80.6 ± 6.0	−0.772	0.442
Systolic TA (mmHg)	125.2 ± 8.1	123.7 ± 6.8	0.977	0.331
Diastolic TA (mmHg)	68.5 ± 8.7	69.8 ± 8.6	−0.725	0.470
Blood glucose (mg/dL)	96.5 ± 9.5	99.2 ± 12.1	−1.189	0.237
SPO_2 (%)	97.4 ± 1.8	97.3 ± 1.7	0.178	0.859
Follow-up day				
Fever (°C)	36.4 ± 0.2	36.5 ± 0.3	−0.894	0.374
Heart rate (min)	79.9 ± 5.0	81.5 ± 5.9	−1.370	0.174
Systolic TA (mmHg)	123.7 ± 7.1	122.8 ± 7.5	0.571	0.570
Diastolic TA (mmHg)	71.5 ± 8.7	72.6 ± 7.1	−0.656	0.513
Blood glucose (mg/dL)	97.4 ± 16.3	99.6 ± 16.1	−0.642	0.523
SPO_2 (%)	97.6 ± 1.8	97.3 ± 1.8	0.640	0.524
Delta (Δ)				
Fever (°C)	0.015 ± 0.5	0.046 ± 0.3	−0.380	0.705
Heart rate (min)	0.96 ± 12.7	−1.47 ± 8.2	1.091	0.278
Systolic TA (mmHg)	−0.44 ± 11.5	−0.87 ± 8.6	0.205	0.838
Diastolic TA (mmHg)	−1.52 ± 11.5	−0.87 ± 11.5	−0.271	0.787
Blood glucose (mg/dL)	−1.37 ± 10.4	0.35 ± 13.8	−0.673	0.502
SPO_2 (%)	−0.10 ± 2.4	0.74 ± 2.1	−1.796	0.076

Δ: Difference between preoperative and discharge day; SD: Standard deviation.
*$p < 0.05$; **$p < 0.01$.

Preoperative pain (81.5%), nausea (67.4%), and vomiting (35.9%) were the most common symptoms, and most patients had regular defecation (87%) and were able to bathe independently (97.8%) (Table S4). Upon discharge, nausea, vomiting, and defecation decreased to 13%, 4.3%, and 40.2%, respectively, and nearly all the patients (97.8%) were unable to bathe. At follow-up, the gastrointestinal symptoms had nearly resolved with no vomiting and minimal pain or nausea. Defecation returned to 80.4% however, a significant proportion (70.6%) required family assistance for bathing.

Preoperative assessment revealed that pain ($\chi^2 = 5.845$, $p = 0.016$) and defecation rates ($\chi^2 = 9.583$, $p = 0.002$) were significantly higher in the experimental group. No other significant differences were observed in nausea, vomiting, walking duration, or bathing ability ($p > 0.05$). On discharge day, the experimental group reported significantly less vomiting ($\chi^2 = 4.182$, $p = 0.041$) but more pain ($\chi^2 = 11.210$, $p = 0.001$) than the control group. The differences in other clinical parameters were not statistically significant (Table 3).

At follow-up, the experimental group demonstrated higher defecation rates ($\chi^2 = 17.682$, $p < 0.001$) and higher bathing-related support needs (i.e., need for family assistance for bathing) ($\chi^2 = 15.151$, p = 0.001), indicating statistically significant differences. The other follow-up indicators showed no significant intergroup variations.

Most functional recovery variables demonstrated moderate to strong associations with the educational method, as determined by Cramér's V effect sizes (Fig. S1). Notably, follow-up defecation (V = 0.48), discharge pain (V = 0.44), and follow-up bathing-related support needs (V = 0.42) exhibited large effect sizes. Additionally, vomiting at discharge (V = 0.30) and preoperative pain (V = 0.28) indicated moderate effects. These findings suggest that video-assisted education may influence selected functional recovery indicators and symptom reporting in the early postoperative period. Preoperatively, the consumption rates of fatty foods, sugary foods, fatty milk, and fatty red meat were high and similar in both groups ($p > 0.05$). At follow-up, the intake of these food categories decreased substantially in both groups, with no statistically significant group differences (p > 0.05).

Vegetable, fruit, and white meat consumption remained high in both groups from the preoperative to follow-up assessments, with 100% adherence observed postoperatively. No significant differences were detected between the groups at any time point (p > 0.05) (Table S5).

4. Discussion

In this study, the experimental group received video-assisted education, whereas the control group received the same content in brochure-based format. While the groups were comparable at baseline for most variables, statistically significant differences were observed in sex, family history of illness, and previous surgical history (Table S2). These imbalances may represent potential confounders and were considered when interpreting the findings. Effect sizes (Cohen's d and Cramér's V) were reported to complement *p*-values and to reflect the magnitude of between-group differences.

4.1. Early gastrointestinal recovery

Preoperative functional parameters showed significantly higher rates of pain and defecation in the experimental group ($p = 0.016$, $p = 0.002$). On the follow-up day, defecation ($p < 0.001$) was significantly more common in the experimental group. While defecation output was present in 87% of patients before surgery, it decreased to 40.2% at discharge and increased to 80.4% on the follow-up day. These results indicate that brochure or video-assisted education may have been associated with behaviors that support bowel movements (early mobilization, adequate fluid intake, nutritional recommendations, etc.), implying a beneficial effect on some postoperative functional outcomes, particularly bowel motility and the resumption of daily living activities. However, the application of general anesthesia, CO_2 administered to the

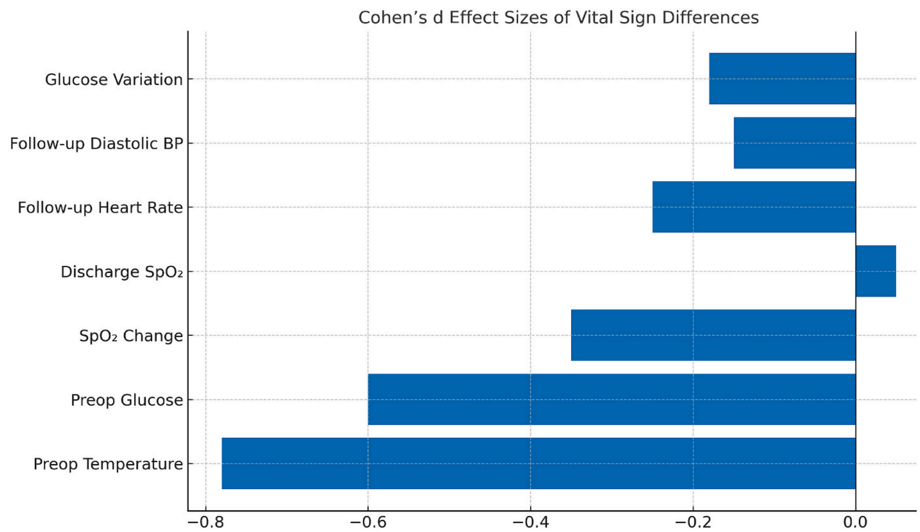

Fig. 2. Cohen's d effect sizes for physiological parameters.

abdomen during surgery, and its temporary effects on gastrointestinal motility may have played a role, as the defecation rate on the day of discharge did not return to the preoperative level [26]. Among patients who had preoperative bowel movements, the timing of the first postoperative defecation shifted to the follow-up day.

4.2. Postoperative nausea and vomiting

In terms of gastrointestinal symptoms, 67.4% of patients reported nausea preoperatively, which decreased to 13% at discharge and 6.5% at follow-up. Vomiting was present in 35.9% of the patients preoperatively, decreasing to 4.3% at discharge ($p = 0.041$; only in the control group) and absent at follow-up. Postoperative mobilization, diet, and fluid intake factors influencing nausea and vomiting were communicated to patients through videos or brochures by a nursing researcher. Antiemetic medications were administered to all patients according to physicians' orders. Whether postoperative nausea and vomiting is primarily influenced by anesthetic agents, intra-abdominal inflammation, or carbon-dioxide-induced intra-abdominal pressure remains uncertain [26]. Therefore, the content of the educational materials may have had a limited influence on these outcomes. The coordinated implementation of standardized techniques to minimize nausea and vomiting could potentially enhance the results.

Pain was present in 81.5% of the patients preoperatively, decreasing to 79.3% at discharge and 3.3% at follow-up. Interestingly, the experimental group reported significantly higher pain levels than the control group on the day of discharge ($p = 0.001$), although pain levels were similar between the groups at follow-up.

Several factors may explain this transient difference. First, structured video education may have increased symptom awareness and encouraged more accurate reporting of pain intensity at the discharge time point, without necessarily increasing nociception. Second, discharge-day pain after laparoscopic cholecystectomy is multifactorial (incisional pain, CO_2-related referred shoulder pain, and visceral irritation), and may be influenced by perioperative analgesic timing, mobilization, and individual pain sensitivity. Third, baseline imbalances (e.g., sex) may contribute to differences in pain perception and reporting and should be considered when interpreting this result. Importantly, the convergence of pain levels by follow-up suggests that the education modality did not have a sustained effect on pain intensity and that postoperative pain trajectories are likely driven by recovery physiology and perioperative management rather than education alone.

At discharge, redness at the surgical site was noted in 13% of patients, which increased to 41.3% at follow-up, with no evidence of discharge or edema. These findings indicate localized inflammatory reactions rather than infection. Even subclinical surgical site inflammation, as indicated by markers such as elevated interleukin-6 and proinflammatory cytokines, is correlated with increased postoperative pain and delayed functional recovery [27,28]. This suggests that variations in pain trajectories are likely linked to the extent of the local inflammatory response rather than to the mode of education delivered. The current ERAS guidelines highlight that postoperative pain control requires not only pharmacological interventions, but also inflammation management and complication prevention strategies [23]. Additionally, preoperative education may indirectly influence pain perception by affecting mobilization, nutrition, and psychological preparedness [29,30].

4.3. Functional recovery and support needs

The walking status of 58.7% of patients in the experimental and control groups was 0–20 min and that of 29.3% of patients was 20–40 min before the operation. On the day of discharge, 83.7% of the patients could walk for 0–20 min and 16.3% of the patients could walk for 20–40 min. On the follow-up day, 65.2% of the patients could walk for 0–20 min and 34.8% for 20–40 min. In both groups, the patients were removed from the bed six hours after surgery, and early mobilization was achieved. The reason for the increase in the walking minutes of patients and the increase in the number of walking patients compared to the period before surgery may be attributable to video- or brochure-based training [31].

Regarding bathing, bathing-related support needs differed between groups at follow-up ($p = 0.001$), with a higher proportion of patients in the experimental group reporting bathing with family assistance.

4.4. Discharge and follow-up day vital signs

Preoperative vital signs revealed significantly lower temperatures, blood glucose, and SpO_2 levels in the experimental group than those in the control group ($p < 0.001$, $p = 0.007$, and $p = 0.033$, respectively). On the day of discharge, only temperature remained significantly different between the groups, and at the follow-up visit, no significant differences in vital signs were detected. These patterns suggest that the initial preoperative differences were unlikely to result from the educational intervention and were more likely to reflect random variability or unmeasured confounding factors.

Regarding food consumption, there was no significant difference between the foods consumed by patients who received information

Table 3
Comparison of patient assessment findings between groups.

	Experiment (n = 46)	Control (n = 46)	χ2	p
	n (%)	n (%)		
Preoperative				
Nausea	32 (69.6)	30 (65.2)	0.198	0.656
Vomiting	16 (34.8)	17 (37)	0.047	0.828
Pain	42 (91.3)	33 (71.7)	5.845	0.016*
Defecation output	45 (97.8)	35 (76.1)	9.583	0.002**
Redness	–	–	–	–
Current	–	–	–	–
Edema	–	–	–	–
Walk				
0–20 dk	28 (60.9)	26 (56.5)	0.498	0.779
20–40 dk	12 (26.1)	15 (32.6)		
40–60 dk	6 (13)	5 (10.9)		
The state of bathing				
No	–	–	2.044	0.153
Yes	44 (95.7)	46 (100)		
Can do it with family support	2 (4.3)	–		
Discharge day				
Nausea	4 (8.7)	8 (17.4)	1.533	0.216
Vomiting	–	4 (8.7)	4.182	0.041*
Pain	43 (93.5)	30 (65.2)	11.210	0.001**
Defecation output	22 (47.8)	15 (32.6)	2.215	0.137
Redness	4 (8.7)	8 (17.4)	1.533	0.216
Current	–	–	–	–
Edema	–	–	–	–
Walk				
0–20 dk	40 (87)	37 (80.4)	0.717	0.397
20–40 dk	6 (13)	9 (19.6)		
40–60 dk	–	–		
The state of bathing				
No	–	1 (2.2)	2.000	0.368
Yes	45 (97.8)	45 (97.8)		
Can do it with family support	1 (2.2)	–		
Follow-up day				
Nausea	2 (4.3)	4 (8.7)	0.713	0.398
Vomiting	–	–	–	–
Pain	1 (2.2)	2 (4.3)	0.345	0.557
Defecation output	45 (97.8)	29 (63)	17.682	<0.001**
Redness	–	–	–	–
Current	–	–	–	–
Edema	–	–	–	–
Walk				
0–20 dk	34 (73.9)	26 (56.5)	3.067	0.080
20–40 dk	12 (26.1)	20 (43.5)		
40–60 dk	–	–		
The state of bathing				
No	2 (4.3)	9 (19.6)	15.151	0.001**
Yes	3 (6.5)	13 (28.3)		
Can do it with family support	41 (89.1)	24 (52.2)		

*p < 0.05, **p < 0.01, χ2: Ki-kare.

through brochures or video-assisted training before the operation and the foods consumed on the day they arrived on the follow-up day (one week after the operation). In both groups, they refrained from eating fat, consumed white meat, or mainly consumed vegetables and fruits. Both groups began to apply the nutritional information provided to patients. According to the current clinical recommendations, patients who undergo cholecystectomy are advised to follow a low-fat, fiber-rich diet and consume smaller, more frequent meals to minimize postoperative gastrointestinal discomfort and support digestive adaptation [32]. Patients who have undergone gallbladder surgery should consume vegetables, fruits, and whole grains in a healthy meal as well as small amounts of lean protein, such as poultry, fish, or fat-free dairy products. Patients should not consume caffeine, dairy products, or sweet foods if they experience diarrhea. These recommendations were consistently followed by the experimental and control groups up until the follow-up day.

4.5. Innovation

Structured preoperative education is emphasized in ERAS pathways as part of goal-oriented recovery support [23]. Although prior studies suggest audiovisual education can reduce preoperative anxiety in some settings [4,33], anxiety was not measured in this trial; therefore, interpretations below are grounded in the outcomes assessed (physiological parameters and functional recovery indicators).

From an innovation perspective, this study supports integrating standardized, video-supported patient education into routine surgical nursing practice as a scalable, patient-centred strategy. By delivering synchronized visual and auditory guidance, video-based education may facilitate understanding of complex postoperative instructions and support retention of key self-care messages.

A second innovative aspect is the inclusion of functional recovery indicators alongside physiological measures. Functional milestones such as bowel function, mobility, and bathing-related support needs are closely linked to patient autonomy and discharge readiness [23-25]. By evaluating these indicators at predefined time points, our trial extends patient education research beyond symptom-focused endpoints.

Accessibility is also central: because smartphones and computers are widely available, patients and family members can rewatch educational videos after discharge, reinforcing understanding and supporting self-management at home.

Physiological stability and gastrointestinal recovery are influenced by clinical context, including anesthetic practices and perioperative factors. Patients were ASA I–III, and variables such as intra-abdominal inflammation and the volume of CO_2 insufflation were not assessed and should be considered as limitations [26]. Supportive measures (e.g., NSAID-based analgesia, early mobilization, gum chewing, abdominal massage) may also influence bowel recovery [34-36]; in this trial, both groups received NSAIDs rather than opioids, which may partly explain similar patterns in some gastrointestinal outcomes.

4.6. Limitations

This study is not without limitations. Although a randomized controlled design was used, the findings are specific to a single center and a particular surgical population. Therefore, they may not be generalizable to other settings or patient groups. Additionally, educational methods' effectiveness may be influenced by individual patient characteristics, such as learning style or prior experience. To strengthen the reliability and applicability of the results, future studies should be conducted in multiple centers with larger and more diverse samples.

5. Conclusions

This study evaluated the effects of video- and brochure-based education in patients undergoing laparoscopic cholecystectomy. Video-assisted education was associated with greater improvements in certain aspects of postoperative functional recovery, particularly in defecation and bathing. However, there were no significant differences between groups in terms of vital signs, pain levels, or nutritional behavior. These findings suggest that although video-based education may support specific recovery parameters, its overall effect may vary depending on the surgical context and patient characteristics.

Educational strategies provided during the preoperative period should incorporate both visual and auditory elements to increase engagement, enhance comprehension, and support postoperative self-care. Although this study did not directly test a combined model, the integration of video- and brochure-based education may offer additional benefits and should be explored in future research to determine its effectiveness in promoting recovery and patient independence.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

We used ChatGPT (OpenAI, GPT-5) only to assist with figure/graph layout and labels from author-generated data. No text, analyses, or references were generated by AI. All content was written and verified by the authors, who take full responsibility.

Authors contribution

Elif Pehlivan: Conceptualization; Methodology; Software; Validation; Formal analysis; Investigation; Resources; Data curation; Visualization; Project administration; Writing—original draft. **Berna Dizer:** Conceptualization; Methodology; Validation; Supervision; Project administration; Writing—review and editing. **Arzu Tuna:** Validation; Project administration; Methodology; Writing—review and editing.

CRediT authorship contribution statement

Elif Pehlivan: Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Berna Dizer:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Conceptualization. **Arzu Tuna:** Writing – review & editing, Validation, Project administration, Methodology.

Informed consent statement

All participants provided written informed consent after being informed of the purpose and scope of the study. Written consent was collected through forms distributed at the start of the data collection phase.

Institutional review board statement

Ethical approval was obtained from the Gaziantep Provincial Health Directorate and Izmir Tınaztepe University Clinical Research Ethics Committee prior to commencing the study (Approval Date: September 14, 2022; Approval No.: 07). This study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pecinn.2026.100488.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

[1] Jones MW, Weir CB, Marietta M. Gallstones (Cholelithiasis). https://www.ncbi.nlm.nih.gov/books/NBK459370/;; 2025.
[2] Nam C, Lee JS, Kim JS, Lee TY, Yoon YC. Evolution of minimally invasive cholecystectomy: a narrative review. BMC Surg 2024;24:378. https://doi.org/10.1186/s12893-024-02659-x.
[3] Blencowe NS, Strong S, AGK McNair, Brookes ST, Crosby T, Griffin SM, et al. Reporting of short-term clinical outcomes after esophagectomy: a systematic review. Ann Surg 2012;255:658–66. https://doi.org/10.1097/SLA.0b013e3182480a6a.
[4] Dinç M, Tuna A. The effect of brochure based training on anxiety, pain, and life findings for patients undergoing laparoscopic cholecystectomy: a quasi-experimental study. Int J Caring Sci 2024;17:390–400.
[5] Roy DK, Sheikh R. A systematic review and meta-analysis of the outcomes of laparoscopic cholecystectomy compared to the open procedure in patients with gallbladder disease. Avicenna J Med 2024;14:3–21. https://doi.org/10.1055/s-0043-1777710.
[6] Toro JP, Lin E, Patel AD, Watson W, Zundel N, Szomstein S. Same-day discharge after laparoscopic cholecystectomy: what predicts adverse outcomes? Surg Edosc 2021;35:1510–7.
[7] Carlomagno N, Tammaro V, Scotti A, Candida M, Calogero A, Santangelo ML. Is day-surgery laparoscopic cholecystectomy contraindicated in the elderly? Results from a retrospective study and literature review. Int J Surg 2016;33:S103–7. https://doi.org/10.1016/j.ijsu.2016.06.024.
[8] Yu P, Shen-Nien W, King Teh L. Robotic versus conventional laparoscopic cholecystectomy: a comparative study of medical resource utilization and clinic outcomes. Kaohsiung J Med Sci 2017;33:201–6. https://doi.org/10.1016/j.kjms.2017.01.010.
[9] Timerga S, Befkadu A. Prevalence and associated factors of postoperative nausea and vomiting among adult patients undergoing elective surgery. Ann Med Surg 2024;86:1304–8. https://doi.org/10.1097/MS9.0000000000001678.
[10] Zhang Z, Wang X. The neural mechanism and pathways underlying postoperative nausea and vomiting: a comprehensive review. Eur J Med Res 2025;30:362. https://doi.org/10.1186/s40001-025-02632-1.
[11] Centers for Disease Control and Prevention. National Healthcare Safety Network (NHSN) patient safety component manual. https://www.cdc.gov/nhsn/pdfs/validation/2022/pcsmanual_2022_508.pdf; 2022 [accessed 15 October 2024].
[12] Sert I, Ipekci F, Engin Ö, Karaoğlan M, Özhan Ö. Outcomes of early cholecystectomy (within 7 days of admission) for acute cholecystitis according to diagnosis and severity grading by Tokyo 2013 guideline. Turk J Surg 2017;33:80–6. https://doi.org/10.5152/UCD.2016.3305.
[13] Youssef NFA, Hassan ADA. The effect of hand and foot massage on alleviating pain and anxiety of abdominal post-operative patients. IOSR J Nurs Health Sci 2017;6:5–56. https://doi.org/10.9790/1959-0603035665.
[14] Yıldırım N, Çiftçi B, Kaşıkçı M. Hemşirelerin hasta eğitimi verme durumu ve etkileyen faktörlerin belirlenmesi [determining the factors affecting and the practice of patient education among nurses]. Atatürk İletişim Derg 2017;14:217–31 [in Turkish].
[15] Öskan DS, Tuna A, Soylu D. Virtual reality training intervention to reduce pain and anxiety: a quasi-experimental study. Bingol Univ Health J 2024;5:250–6. https://doi.org/10.58605/bingolsaglik.1505034.
[16] Orgun F, Akkoç C. Assessment of patient education materials: readability formulas and materials assessment tool. Turkiye Klinikleri J Nurs Sci 2020;12:412–8. https://doi.org/10.5336/nurses.2020-74172.
[17] Sadati L, Pazouki A, Mehdizadeh A, Shoar S, Tamannaie Z, Chaichian S. Effect of preoperative nursing visit on preoperative anxiety and postoperative complications in candidates for laparoscopic cholecystectomy: a randomized clinical trial. Scand J Caring Sci 2013;27:994–8. https://doi.org/10.1111/scs.12022.
[18] Elsayed AM, Taha NM, Metwaly EA. Nurses' knowledge and practice regarding care for patients undergoing cholecystectomy. Zagazig Nurs J 2021;17:13–21.
[19] Shamekhi A, Moosaalreza T, Rastaghi S, Molavi M. Comparison of the effect of video education and guided imagery on patient anxiety before endoscopy. Biomed Res 2019;30. https://doi.org/10.35841/biomedicalresearch.30-19-036.
[20] Gaikwad RR, Diwate A, Das A, Ahya N. Comparative study of self-demonstration versus video based education on level of anxiety and self-efficacy in patient undergoing cardiac surgery: a double-blinded randomized controlled trial. Indian J Pub Health Res Dev 2021;12:163–9. https://doi.org/10.37506/ijphrd.v12i3.16060.
[21] Habibzadeh H, Milan ZD, Radfar M, Alilu L, Cund A. Effects of peer-facilitated, video-based and combined peer-and-video education on anxiety among patients undergoing coronary angiography: randomised controlled trial. Sultan Qaboos Univ Med J 2018;18:e61–7. https://doi.org/10.18295/squmj.2018.18.01.010.
[22] Rodriguez HA, Young MT, Jackson HT, Oelschlager BK, Wright AS. Viewer discretion advised: is YouTube a friend or foe in surgical education? Surg Endosc 2017;32:1724–8. https://doi.org/10.1007/s00464-017-5853-x.
[23] Gustafsson UO, Rockall TA, Wexner S, How KY, Emile S, Marchuk A, et al. Guidelines for perioperative care in elective colorectal surgery: enhanced recovery after surgery (ERAS) society recommendations. Surgery 2025;184:109397. https://doi.org/10.1016/j.surg.2025.109397.
[24] Lee J, Asher V, Nair AB, White VA, Brocklehurst C, Traves M, et al. Comparing the experience of enhanced recovery programme for gynaecological patients undergoing laparoscopic versus open gynaecological surgery: a prospective study. Perioper Med 2018;7:15. https://doi.org/10.1186/s13741-018-0096-5.
[25] Maheta B, Shehabat M, Khalil R, Wen J, Karabala M, Manhas P, et al. The effectiveness of patient education on laparoscopic surgery postoperative outcomes

to determine whether direct coaching is the best approach: systematic review of randomized controlled trials. JMIR Perioper Med 2024;7:e51573. https://doi.org/10.2196/51573.
[26] Van Dijk RM, Watts RW, Ledowski T, Trochsler M, Moran JL, Arenas GWN. Deep neuromuscular block reduces intra-abdominal pressure requirements during laparoscopic cholecystectomy: a prospective observational study. Acta Anaesthesiol Scand 2015;59:434–40. https://doi.org/10.1111/aas.12491.
[27] Ailioaie RC, Stefanescu E, Leahu C, Boldis A, Scurtu R. The influence of analgesic wound infiltration on postoperative pain and inflammatory cytokines in open colorectal surgery: a randomized comparative pilot study. Medicina 2024;60:1244. https://doi.org/10.3390/medicina60081244.
[28] Fernández-Martínez A, García JG, López-Picado A. Anti-inflammatory and immunomodulatory effects of intravenous lidocaine in surgery: a narrative review. J Clin Med 2025;14:3883. https://doi.org/10.3390/jcm14113883.
[29] Liu M, Cao W, Xu G, He Y, Du Z, Yuan T. Knowledge, attitudes, and practices survey on postoperative pain management in gastrointestinal surgery patients: a cross-sectional study. Griatr Nurs 2025;63:105–12. https://doi.org/10.1016/j.gerinurse.2025.03.022.
[30] Pazar B, Iyigun E. The effects of preoperative education of cardiac patients on haemodynamic parameters, comfort, anxiety and patient-ventilator synchrony: a randomised, controlled trial. Intensive Crit Care Nurs 2020;58:102799. https://doi.org/10.1016/j.iccn.2020.102799.
[31] Akkurt T. The effect of warm water to the functions of the gastrointestinal system that given the patients after laparoscopic hysterectomy surgery. Master's thesis. Istanbul, Türkiye: Marmara University; 2019.
[32] Ribas Blasco Y, Pérez Muñante M, Gómez-Fernández L, Jovell-Fernández E, Oms Bernad LM. Low-fat diet after cholecystectomy: should it be systematically recommended? Cir Esp 2020;98:36–42. https://doi.org/10.1016/j.ciresp.2019.05.009.
[33] Toğaç HK, Yılmaz E. Effects of preoperative individualized audiovisual education on anxiety and comfort in patients undergoing laparoscopic cholecystectomy: randomised controlled study. Patient Educ Couns 2021;104:603–10. https://doi.org/10.1016/j.pec.2020.08.026.
[34] Ma CH, Tworek KB, Kung JY, Kilcommons S, Wheeler K, Parker A, et al. Systemic nonsteroidal anti-inflammatories for analgesia in postoperative critical care patients: a systematic review and meta-analysis of randomized control trials. Crit Care Explor 2023;5:e0938. https://doi.org/10.1097/CCE.0000000000000938.
[35] Öztaş İ, Yava A, Koyuncu A. The effect of early mobilization on constipation after abdominal surgery: a systematic review: the effect mobilization on constipation. J Surg Med 2024;8:151–5. https://doi.org/10.28982/josam.7832.
[36] Tuscharoenporn T, Uruwankul K, Charoenkwan K. Effects of postoperative gum chewing on recovery of gastrointestinal function following laparoscopic gynecologic surgery: systematic review and meta-analysis of randomized controlled trials. J Clin Med 2024;13:2851. https://doi.org/10.3390/jcm13102851.

Glossary

Laparoscopic cholecystectomy: A minimally invasive surgical procedure to remove the gallbladder using small abdominal incisions and a laparoscope.
Video-assisted education: A structured preoperative patient education method delivered via video, including information on pain, nausea–vomiting, mobilization, nutrition, fluid intake, wound care, bathing, and follow-up.
Brochure-based education: A preoperative patient education method in which the same content as the video is provided in the form of a printed leaflet/brochure.
Visual Analog Scale: A 0–10 scale used to assess pain intensity, where 0 indicates "no pain" and 10 indicates "the worst pain imaginable."
Peripheral oxygen saturation (SpO_2): A non-invasive estimate of arterial oxygen saturation measured by pulse oximetry, expressed as a percentage.
Postoperative day (POD): The number of days after the surgical procedure (e.g., POD 1 = the first day after surgery).
Body mass index: A measure of body size calculated as weight in kilograms divided by height in meters squared (kg/m^2).