



The Effect of psychological intervention based on the mobile application on the anxiety level of cholecystectomy candidates

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Abstract

Background and aims: This study aims to investigate the effect of psychological intervention based on the mobile application on the anxiety level of laparoscopic cholecystectomy candidates.

Methods: This semi-experimental was conducted on 60 laparoscopic cholecystectomy candidates in 2022 in Shahrekord. The participants were randomly divided into control and test groups using the block randomization method. The test group received a psychological intervention based on a mobile application installed on their mobile phones and used for two months. The control group received usual hospital care only. Data were collected before, immediately after, and two months after the intervention using the Spielberger Anxiety Questionnaire. Descriptive and inferential statistics (chi-square, Fisher's exact test, independent t-test) were used to analyze the data in SPSS 24 software.

Results: Before the intervention, the average scores for state anxiety in the test and control groups were 45.97 ± 11.71 and 46.00 ± 11.10 , respectively. The average scores for trait anxiety were 43.60 ± 10.24 and 44.37 ± 10.55 in the test and control groups, respectively. There were no significant statistical differences between the groups regarding state anxiety ($P=0.99$) and trait anxiety ($P=0.78$). However, immediately after the intervention, the test group showed significantly lower scores for state anxiety ($P=0.01$) and trait anxiety ($P=0.04$). Additionally, two months after the intervention, there was a significant difference in the average scores for state anxiety ($P=0.03$) and trait anxiety ($P=0.02$) between the two groups.

Conclusion: Psychological intervention based on a mobile application can be an efficient and cost-effective way to manage anxiety in cholecystectomy candidates.

Keywords: Psychological intervention, Mobile application, Anxiety, Cholecystectomy

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Introduction

Gallbladder disease is a common clinical disease (1). Gallstones are a significant problem related to the digestive system. Acute and chronic inflammatory diseases of the gallbladder are mainly caused by gallstones (2). Cholelithiasis (gallbladder stones) leads to hospitalization more than any other digestive disease (3). The incidence of gallstones increases with age; more gallstones are formed in women than men. At 50 to 65, almost 20% of women and 5% of men have gallstones (4).

About 20% of Europeans suffer from gallstone disease (3). In the United States, there are almost 20 million people with gallstones, of which approximately 300 000 people undergo cholecystectomy yearly (4). Cholecystectomy is one of the most prevalent surgeries in the world. This surgery treats diverse gallbladder disorders, such as symptomatic gallstones, cholecystitis, and gallbladder tumors (5,6).

Anxiety is current among inpatients waiting for surgery and causes acute mental discomfort before,

during, and after surgery (7,8). Surgery is a dangerous treatment generally affiliated with pain, bloodshed, peril of complications, and occasionally demise. Patients who are candidates for surgery may avoid such procedures due to the unpleasant experience of anxiety (9). Various studies have investigated the amount and prevalence of preoperative anxiety (10-14).

Ahmetovic-Djug et al showed that all patients had different levels of overt anxiety before the operation, with 4% or 5% of patients having low levels of overt anxiety, 60% or 75% of patients having moderate levels of overt anxiety, and 16% or 20% of patients having a high level of overt anxiety (14). According to Kanwal and colleagues' study, 62.8% of patients had significant anxiety before the operation (13).

Patients are worried and anxious before the operation for various reasons, including the fear of not recovering from anesthesia, postoperative pain, family matters, dependency, fear of dying, complications and disability, financial loss, cosmetic issues, medical errors, and

awareness during anesthesia (12). Anxiety before surgery is one of the most crucial issues for patients (15), and it can be defined as a completely distressing situation for sufferers (16) because it causes mental and physical problems as well (15). Anxiety affects physiological and psychological parameters (9).

Anxiety leads to cognitive issues characterized by thinking, decision-making, apperception, and concentration disruption. Anxiety before surgery greatly affects the outcomes of the operation (9); in addition to the significant discomfort that patients experience (8), a higher level of anxiety increases the risk of such complications and fatality (17).

It also increases the cortisol level in the body, leading to slower wound healing, diminished immune response, and an increased chance of infection (7). It also leads to increased painkiller utilization, complications, prolonged recovery, and longer hospital stays (12).

Therefore, patients who prepare themselves for surgery should not experience unnecessary anxiety. For some, even the thought of surgery and anesthesia increases anxiety (14). One way to decrease anxiety in patients is to use sedatives. However, some doctors believe that sedatives have side effects on the cardiovascular and respiratory systems (18), and the use of benzodiazepines, the most common method to reduce preoperative anxiety, does not positively affect the postoperative outcome (19).

Antianxiety drugs also interact with other medications prescribed by anesthesia and can cause delayed recovery and discharge time (7). Hence, considering the different side effects of drugs, it is essential to provide a suitable non-pharmacological approach (20). Currently, the focus is on alternative psychological measures to diminish anxiety, and different non-pharmacological measures are being investigated (7).

Psychological preparation includes plans to affect human emotions, thoughts, or actions (21). Implementing nursing strategies from a psychological perspective for patients is a psychological nursing intervention that assists in preserving the peace of mind and active cooperation of patients in treatment and nursing to enhance the effectiveness of surgery and prognosis (22).

Psychological interventions that decrease negative feelings, including tension and fear of surgical operation and perceived stress, or alter patients' healing-related behavior, may result in effective postoperative outcomes and improved postoperative results, offering a wide range of benefits (21). Preoperative information or education is the stage of psychologically preparing the patient for surgery (23). Lack of knowledge and uncertainty is associated with preoperative anxiety, so a method to reduce preoperative tension is to provide information or education to patients before the operation (24).

Various research outcomes show the impact of preoperative education on reducing anxiety (25-27). This educational method must begin before surgery and continue until discharge from the medical institution (2).

However, patient education is often delivered in an acute or critical care cycle that is informal, ad hoc, and highly fragmented (28,29).

In Iran, nursing is the largest healthcare profession that plays a central role in patient education. However, patient education is a growing concern for Iran's healthcare system. Studies have shown that Iranian nurses face obstacles in patient education (30). Various communication methods are used to educate patients. However, since patients are frequently unable to participate in a formal educational program, mobile-based education has created possibilities to provide important information at the individual's location (20,31).

Doctors and patients have found that mobile applications provide a fast and efficient way to communicate and exchange information (32-35). Morte and colleagues' study showed that using mobile applications improves training during the operation period, increases satisfaction in general surgery patients, and has high usability among users (36).

Laparoscopic cholecystectomy is one of the most common surgeries, and it is significant in controlling patients' anxiety during surgical operations. Special follow-up and support programs are not carried out for this group of patients, so it is necessary to intervene for patients who are candidates for surgery during the operation period. Considering the limitations of face-to-face training, it is reasonable to use low-cost and accessible methods. Therefore, considering the advantages of applications, the present study was designed and conducted to investigate the effect of psychological intervention based on a mobile application on the anxiety level of patients who are candidates for laparoscopic cholecystectomy surgery.

Materials and Methods

Design

This research was a two-group, semi-experimental, and single-blind study. The statistical analyzer was blind to the content of the interventions. The current research on laparoscopic cholecystectomy candidates was conducted in 2022 at Ayatollah Kashani Hospital in Shahrekord, Iran.

Based on the information from Toğaç and Yılmaz's study, taking into account the difference between the anxiety scores of the two groups equal to 5.3, the standard deviation of 3.5 and 4.8, as well as the first and second type errors of 0.01 and 0.1, the required sample size according to the following formula, is equal to 24 people in each group (2). Considering the 20% dropout, 30 patients in each group were included in the study.

$$N = \frac{(S_1^2 + S_2^2) \left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta} \right)^2}{(\mu_1 - \mu_2)^2}$$

The samples were selected gradually using the convenience sampling method. Sampling was conducted on different days to avoid contamination of the control and test groups. The control group was sampled on odd

days, while the test group was on even days.

The inclusion criteria for participants were being a candidate for laparoscopic cholecystectomy, being age 18 years or older, having the desire and informed consent to participate in the research, owning a smartphone, and having the ability to use the software either by the patient or by at least one of their family members who can operate the smartphone. Other inclusion criteria included the ability to read and write for oneself or a close family member, no history of mental problems or anxiety disorders, good communication skills, and no learning or hearing problems. Exclusion criteria for participants include unwillingness or lack of cooperation to continue at any stage of the research, not using the application throughout the entire study period, experiencing physical or mental problems that make hindered cooperation, and the death of the patient.

Randomization

The block randomization method was implemented using RA software for random allocation.

Intervention

This research was conducted in two phases: the first phase involved designing and creating the application, and the second phase focused on the intervention.

First phase: design and construction of the application

During this phase, the research team and the psychiatric nurse collaborated to prepare the application's content. This content included educational materials; care needs for cholecystectomy candidates, and relaxation techniques such as movies and nature music. The team searched extensively by referring to books, articles, and up-to-date websites, which a specialist surgeon approved. Next, a programming expert prepared the content as an application that could be installed on Android operating systems. It took approximately one month to complete the application, which had a size of 15.28 MB and could be shared with others. The designed application was approved by the information technology expert and ethics committee of Shahrekord University of Medical Sciences.

The content of this section included information about the function of the gallbladder, gallbladder removal, surgical methods, and anesthesia, the reason for gallbladder removal, necessary procedures and measures before deciding on surgery, benefits and risks of gallbladder removal, pre-surgery measures and care, post-surgery recovery, expected feelings after surgery, resumption of activities, wound and surgical incision care, resumption of nutrition, prevention of respiratory complications, warning signs, and follow-up care. The content was presented in simple language and accompanied by images. The educational videos section included videos on performing open and laparoscopic cholecystectomy surgery, wound and dressing care, and pre-and post-surgery surgery care instructions, including

movement in bed and deep breathing techniques.

Moments of peace were provided through nature videos with music, picture music, and instrumental music.

Second phase: intervention

Candidates for laparoscopic cholecystectomy were selected using a convenience sampling technique based on inclusion criteria. The study's purpose, method, and duration (two months) were explained clearly to the patient and their companions. Written informed consent was acquired after obtaining their agreement to participate in the research.

Before the intervention, the questionnaires were completed through interviews One day before surgery. In the test group, the researcher installed an application specifically designed for cholecystectomy patients on the patient's or companion's smartphone. They were given instructions on using the program and received the necessary training. In addition to the normal care provided by the hospital, the test group used the researcher's application, while the control group received only normal hospital care.

On the day of the surgery, the researcher visited the hospital to complete the second-stage questionnaires immediately after the surgery through patient interviews. The test group was instructed to continue using the application after discharge from the hospital and for two months after surgery. During the two months study period, the test group patients were contacted weekly via telephone to monitor their application usage. A WhatsApp group was created for the test group to address any questions or concerns about the software or intervention. Two months after surgery, patients or companions were asked to complete the third stage of the questionnaire electronically.

Outcome measures

This study is a standalone study. The data for this research was collected through a demographic information questionnaire and Spielberger State-Trait Anxiety Inventory (STAI). Anxiety is a primary variable measured in three stages, before the intervention, immediately after, and two months after. Spielberger's anxiety questionnaire consists of two parts, state and trait anxiety, with 40 questions. The state anxiety scale is a 20-item scale that measures a person's feelings at a specific moment and during accountability. The trait anxiety scale also consists of 20 phrases that evaluate individuals' overall and usual feelings most of the time. For both state and trait anxiety, the scores obtained from the questionnaire range from 20 to 80, which are qualitatively rated. A score of 20 to 31 indicated mild anxiety, 32 to 42 is moderate to low anxiety, 43 to 53 is moderate to high anxiety, 54-64 is relatively severe anxiety, 64-73 is severe anxiety, and a score of 73-80 is very severe anxiety (37). Spielberger's anxiety questionnaire has been used and validated in multiple studies, confirming reliability by Cronbach's

alpha method of 0.91 (38).

Validity and reliability

This study adheres to the CONSORT guidelines (Figure 1).

Statistical data analysis

Data were analyzed using chi-square tests, Fisher's exact test, and independent *t* test. Additionally, repeated measurement analysis was conducted in SPSS 24 software to compare the within-group changes, with a significance level of $P < 0.05$.

Results

Socio-demographic information

A total of 60 laparoscopic cholecystectomy candidates participated in and completed the questionnaires until the end of the study (Figure 1).

The average age in the test group was 46.10 ± 11.63 years; in the control group, it was 44.53 ± 16.71 years; this difference was insignificant ($P = 0.68$). Also, the two groups had no statistically significant differences regarding demographic variables such as gender, marital status, education level, and surgical history (Table 1).

Anxiety of patients

Before the intervention, the mean score of state anxiety in the test group was 45.97 ± 11.71 ; in the control group, it was 46.00 ± 11.10 . The test group's mean trait anxiety score was 43.60 ± 10.24 , and in the control group, it was 44.37 ± 10.55 . Based on the *t*-test of two independent

samples before the intervention, there was no statistically significant difference between the groups regarding the average state anxiety score ($P = 0.99$) and trait anxiety ($P = 0.78$). However, immediately after the intervention, there was a statistically significant difference between the two groups in the mean score of state anxiety ($P = 0.01$) and trait anxiety ($P = 0.04$). Two months after the intervention, there was also a significant difference between the two groups in the mean score of state anxiety ($P = 0.03$) and trait anxiety ($P = 0.02$) (The trend of anxiety level in both groups is shown in Figure 2). In the intra-group comparison, the average score of state anxiety ($P = 0.004$) and trait anxiety ($P = 0.002$) in the test

Table 1. Demographic characteristics in two group

Variable		Control group		Test Group		P-value
		N	%	N	%	
Gender	Female	24	80.0%	25	83.3%	0.74 ^a
	Male	6	20.0%	5	16.7%	
Marital status	Single	7	23.3%	1	3.3%	0.052 ^b
	Married	23	76.7%	29	96.7%	
Education level	Illiterate	7	23.3%	3	10.0%	0.58 ^a
	Under diploma	9	30.0%	10	33.3%	
	Diploma	7	23.3%	9	30.0%	
	University	7	23.3%	8	26.7%	
Surgery history	No	8	26.7%	9	30.0%	0.77 ^a
	Yes	22	73.3%	21	70.0%	

^a Chi-square test.

^b Fisher exact test.

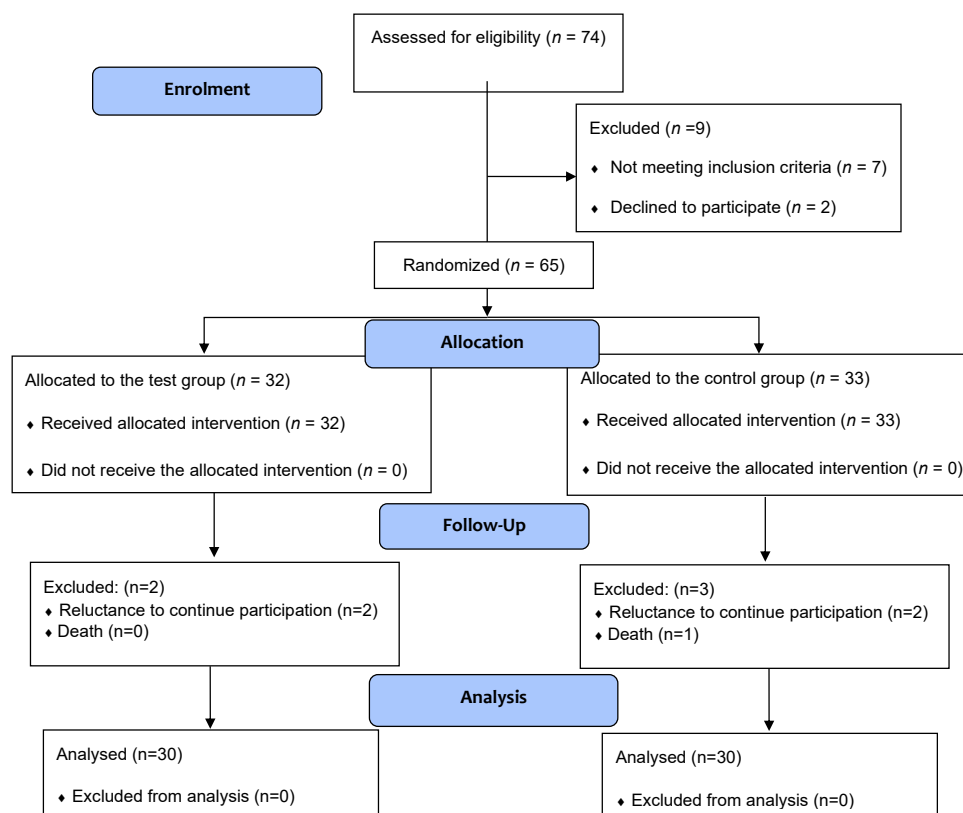


Figure 1. CONSORT Flow chart of the sampling process

group were statistically significantly Different before, immediately after, and two months after the intervention. However, in the control group, there was no significant difference in the mean score of state anxiety ($P=0.10$) and trait anxiety ($P=0.60$) (Table 2).

Discussion

This study examined the impact of a mobile application-based psychological intervention on the level of anxiety in candidates for laparoscopic cholecystectomy. The study results showed that the average state and trait anxiety score before the intervention was not statistically significant in both groups. However, this difference became statistically significant after the intervention. Additionally, the average state and trait anxiety score before and after the intervention was statistically significant in the test group but not in the control group. Therefore, these findings can be attributed to mobile application-based psychological intervention.

Cholecystectomy Candidates experience anxiety similar to other surgical patients (14). Preoperative anxiety is often associated with a lack of information and uncertainty, which can be addressed through patient education (24). In this study, patient education was a key component of the psychological intervention. The results of this study were consistent with previous studies by Abd El Gwad Elkalashy and Masry (27) and Hashemi et al (26), which demonstrated the effectiveness of preoperative educational intervention in reducing patients' anxiety. Yılmaz and Togaç also reported in their study that preoperative audiovisual training tailored to patients' needs increased comfort, reduced anxiety, and positively

affected vital signs in laparoscopic cholecystectomy patients (2). Comparing the results of this study with the previous research, we found a significant agreement on which preoperative training reduces patients' state anxiety effectively. However, there are differences between our findings and the results of another study. Contrary to our findings, that study did not find a significant difference between the two groups in the average trait anxiety score before and after the intervention. This discrepancy may be attributed to the duration of the intervention, the time of data measurement, and the type of intervention used.

On the other hand, psychological intervention is performed to improve the outcome of surgery because many patients experience anxiety and negative thought when approaching surgery, and these pre-surgical factors can impact surgical results (21). In this regard, Zhao and colleagues' study demonstrated that psychological intervention in patients undergoing lung cancer surgery alleviated pain effectively, improved immune system function, and enhanced patients' quality of life (39). Kahokehr and colleagues' research also showed that perioperative psychological intervention reduced patients' fatigue 30 days after laparoscopic cholecystectomy (40). With the widespread use of smartphones and the availability of numerous mobile applications, mobile technology has revolutionized healthcare (41). In their study, Morte et al reported that 86% of patients felt that the app enhanced their overall surgical experience. Furthermore, 98% of patients stated that the app provided crucial preoperative reminders. 90% believed that the program clarifies preoperative information. Additionally, 90% of patients expressed their desire for this program

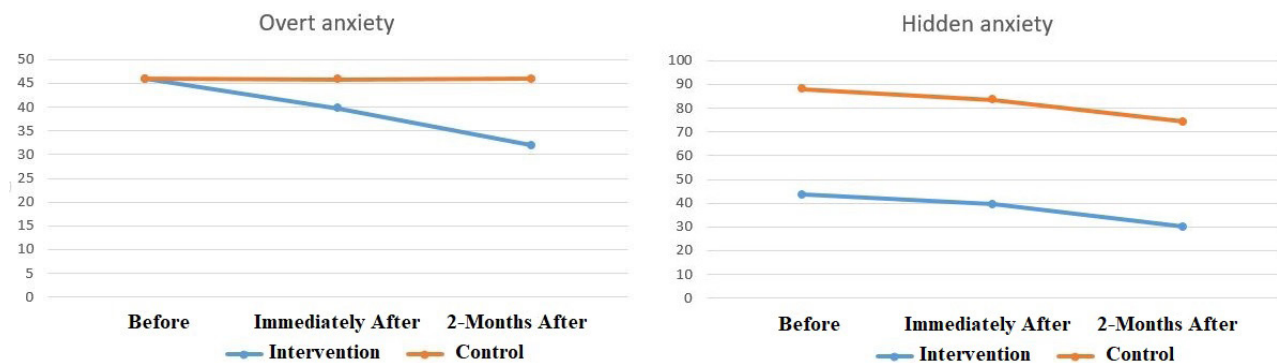


Figure 2. The trends of anxiety scores in different groups

Table 2. Anxiety score before, immediately and two months after intervention in both group

Variable	Group	Time			P value Intergroup	The effect of group	The interaction effect
		Before	Immediately after	2months after			
State anxiety	Intervention	45.97 ± 11.71	39.70 ± 13.90	32.00 ± 11.35	0.004 ^b	<0.001	<0.001
	Control	46.00 ± 11.10	45.83 ± 15.25	45.97 ± 11.96	0.10 ^b		
P value between groups		0.99 ^a	0.01 ^a	0.03 ^a	-		
Trait anxiety	Intervention	43.60 ± 10.24	39.60 ± 8.92	30.03 ± 9.27	0.002 ^b	<0.001	<0.001
	Control	44.37 ± 10.55	44.00 ± 10.51	44.17 ± 11.61	0.60 ^b		
P value between groups		0.78 ^a	0.04 ^a	0.02 ^a	-		

^a Two independent sample t-test; ^b Repeated measures test.

for future surgery (36). These findings align with the results of the present study, which were consistent with the study conducted by Zafari et al (25), demonstrating that mobile-based training methods effectively reduce patients' anxiety. Vahidi and Mahmoodfekhe conducted a study comparing the effectiveness of mobile education and speech therapy on the anxiety of heart surgery patients. Their study revealed that education delivered through mobile phones and lectures reduced patients' anxiety, with no significant difference observed between the two methods (20). In the current study, considering the increasing use of smartphones and their benefits in education, this method was employed to train patients without needing in-person attendance and travel. This approach facilitates the provision of health services.

Our findings show that psychological intervention based on mobile applications can be a low-cost, accessible, and effective method to reduce anxiety in candidates for cholecystectomy. This intervention can improve patient's quality of life and increase their satisfaction and confidence. Additionally, our findings indicate that using music and nature video as calming methods can reduce anxiety, although most physicians tend to prescribe antianxiety drugs for this purpose.

A key strength of the current study was the innovation in applying applications for post-surgery patients. Implementing the application minimized face-to-face visits, reducing stress and increasing patient satisfaction. However, the study had several limitations, including the selection of patients undergoing laparoscopic cholecystectomy, which may limit the generalizability of the results to other patient populations, such as those undergoing open cholecystectomy. Additionally, the use of smartphone applications may be more readily embraced by younger individuals, thereby limiting its applicability to older patients.

Conclusion

The findings of this study demonstrate that implementing psychological intervention based on mobile applications reduces anxiety effectively in candidates for laparoscopic cholecystectomy. Using the application is a useful, low-cost, and safe method that provides patients with reliable information easily and quickly. It is recommended that the managers and planners consider incorporating these new technologies into patient education and health interventions. Furthermore, future research should investigate the effects of mobile applications-based intervention on anxiety levels in other surgical patient populations.

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Authors' Contribution

Conceptualization: Fatemeh Aliakbari.

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Competing Interests

The authors declare that there is no conflict of interest.

Ethical Approval

The Ethics Committee of Shahrekord University of Medical Sciences approved this study (Ethical Code: IR.SKUMS.REC.1401.023). The participants were informed about the purpose and method of the study, and written informed consent was obtained from them.

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