Effect of SMS Reminder Use on Postoperative Breathing and Coughing Exercise Compliance: Randomized Controlled Trial

SMS Hatırlatıcı Kullanımının Ameliyat Sonrası Solunum ve Öksürme Egzersiz Uyumuna Etkisi: Randomize Kontrollü Çalışma

Araştırma Research

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Abstract

Objective: The success of protocols is related to patient compliance. SMS-based interventions increase compliance with protocols in surgical patients and improving patients' clinical participation and satisfaction. The purpose of this randomized controlled trial study was to assess the impact of SMS use on patient satisfaction and adherence to postoperative breathing and coughing exercises in patients undergoing pulmonary lobectomy.

Method: The study included 62 patients who had lobectomies in the thoracic surgery clinic of a university hospital between February 1, 2022, and April 3, 2023. The intervention group was selected as the group that received SMSs.

Results: It was determined that mean number of respiratory exercises on the 4th postoperative day was statiscally significantly higher in the SMS group than in the control group. Similarly, it was determined that the mean number of cough exercises on the 4th postoperative day was significantly higher in the SMS group than the control group. Pain scores were lower in the SMS group than the control group on the fourth postoperative day. In the SMS group, 87.1% of the patients stated that SMS provided an incentive to exercise. The vast majority of patients (87.1%) stated that they were "very satisfied" or "satisfied" with receiving reminder SMS.

Conclusion: The use of SMS increased the adherence of patients following pulmonary lobectomy to postoperative breathing and cough exercises. The majority of patients enjoyed receiving SMS messages, which was discovered to be an incentive for exercising regularly.

The study was registered with ClinicalTrials.gov (NCT05915221).

Keywords: breathing exercises; cancer; short message service; surgery

Özet

Amaç: Protokollerin başarısı hasta uyumu ile ilişkilidir. SMS tabanlı müdahaleler cerrahi hastalarında protokollere uyumu artırmakta ve hastaların klinik katılımını ve memnuniyetini iyileştirmektedir. Bu randomize kontrollü çalışma, akciğer kanseri cerrahisi için pulmoner lobektomi geçiren hastalarda SMS kullanımının ameliyat sonrası solunum ve öksürük egzersizlerine uyum ve hasta memnuniyeti üzerindeki etkisini değerlendirmeyi amaçlamıştır.

Yöntem: Çalışmaya bir üniversite hastanesinin göğüs cerrahisi kliniğinde 01.02.2022 ile 03.04.2023 tarihleri arasında lobektomi yapılan 62 hasta dahil edildi. Müdahale grubu SMS mesajı alan grup olarak seçilmiştir.

Bulgular: Ameliyat sonrası dördüncü günde ortalama solunum egzersizi sayısının SMS grubunda kontrol grubuna göre istatistiksel olarak anlamlı düzeyde daha yüksek olduğu belirlendi. Benzer şekilde, ameliyat sonrası dördüncü günde ortalama öksürük egzersizi sayısının SMS grubunda kontrol grubuna göre anlamlı olarak daha yüksek olduğu tespit edildi. Ameliyat sonrası dördüncü günde ağrı skorları SMS grubunda kontrol grubuna göre daha düşüktü. SMS grubunda hastaların %87,1'i SMS'in egzersiz yapmak için teşvik edici olduğunu belirtmiştir. Hastaların büyük çoğunluğu (%87,1) hatırlatma SMS'leri almaktan "çok memnun" veya "memnun" olduklarını belirtmiştir.

Sonuç: SMS kullanımı pulmoner lobektomi sonrası hastaların ameliyat sonrası solunum ve öksürük egzersizlerine uyumunu artırmıştır. Hastaların çoğunluğunun SMS mesajları almaktan hoşlandığı ve bunun düzenli egzersiz yapmak için teşvik edici olduğu belirlenmiştir.

Çalışma ClinicalTrials.gov'a (NCT05915221) kaydedilmiştir.

Anahtar Sözcükler: solunum egzersizleri; kanser; kısa mesaj servisi; cerrahi

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Introduction

In lung resections, lung functions change depending on anaesthesia, duration, and type of surgery (1). Anaesthesia causes the depression of the respiratory system and diaphragmatic dysfunction, decreasing the functional residual capacity (2). After lung resection, pulmonary rehabilitation practices are used to activate respiration, ensure bronchial patency by mucus mobilisation, allow gas exchange, maintain lung capacity, reduce pain, and prevent pulmonary complications (3). Patients should be encouraged to cough, inhale deeply, perform oral care, and raise the head of the bed $>30^0$ for pulmonary rehabilitation within the scope of enhanced recovery after surgery (ERAS) protocols (4). Patient compliance is a prerequisite for the effectiveness of ERAS protocols. Since most of the protocols are patient-orientated, the initiation of the protocols and active participation are required (5). Surgical nurses also assume important responsibilities in the implementation of ERAS protocols, ensuring patient participation in the perioperative process and ensuring the success of the process (6). However, sometimes patients may have difficulty in managing the process (5).

It has been observed that postoperative mobile health technologies are used in patients to improve surgical outcomes, reduce anxiety, and increase compliance with medication use and follow-up (7,8). Sending short message service (SMS) based approaches improve patient satisfaction and clinical participation while lowering hospital readmission rates and increasing medication and protocol compliance in surgical patients (8,9). It is also more cost-effective than telephone calls (9). It has been reported that the use of SMS is effective in increasing patient compliance with preoperative instructions in patients undergoing outpatient surgery (10) and improves compliance with postoperative exercises in patients undergoing arthroplastic surgery (11). However, the literature on the effect of text messages on inpatient care is not sufficient (12).

Health technology options for improving adherence to postoperative exercise are diverse, but there is no consensus on the best approach. This emphasises the need for this study. The purpose of this randomized controlled trial study was to determine how SMS use affected patients having pulmonary lobectomies in terms of compliance with postoperative breathing and coughing exercises as well as patient satisfaction.

Methods

Research questions

Does SMS use affect patients having pulmonary lobectomies in terms of compliance with postoperative breathing and coughing exercises?

Does the use of SMS affect satisfaction in patients undergoing pulmonary lobectomy?

Patients and settings

This randomized controlled trial was conducted with the participation of 62 surgical patients. The study was conducted between 01.02.2022 and 03.04.2023 in the thoracic surgery clinic of a university hospital.

According to Cohen's d (Cohen's medium effect size d = 0.5–0.8), it was expected that the study's effect size would be moderate. The effect size was taken as 0.70, power 85%, and 95% confidence level, and sample calculation was performed in the G power 3.1.9.4 programme. It was determined that 62 people should be included in the sample, each group consisting of 31 people (1:1). The inclusion criteria were as follows: undergoing elective pulmonary lobectomy, having preoperative normal lung capacity (pulmonary function test result The forced expiratory volume in 1 second (FEV_1)/forced vital capacity (FVC)=FEV_1/FVC>70%), being willing to participate in the study, having mental competence, not having communication issues in Turkish, having a personal mobile phone and being able to send SMS, being compatible with the use of triflow, having undergone a pulmonary lobectomy for the first time, and being an adult. The patient will be removed from the study if no SMSs are received during the study period.

Randomization

Five patients who stated that they did not volunteer to participate in the study were not included in the study. A simple randomization method was used for randomisation. Patients (n:62) were assigned to the experimental and control groups (1:1) according to the inclusion criteria in the Researcher Randomizer programme. The group that received SMS was selected as the intervention group. The CONSORT 2017 guidelines served as the basis for the study's

execution (Figure 1).

Blinding
No blinding was applied for patients and investigators.

Instruments
The Information Form
Six questions covering sociodemographic characteristics (age, gender, education, comorbidity, smoking, body mass index) made up this form (13).

Postoperative Exercise Follow-Up Chart

The patients' breathing, coughing, and triflow exercises on the 1st and 4th postoperative days, along with the exercise hours, are recorded in a chart.

Postoperative patient evaluation form Four questions (use of analgesics, operation time, and numerical pain scores 1st and 4th postoperative days) concerning pulmonary resection were included in this form. The form was prepared by researchers.

Patient Satisfaction Form
This form includes two questions (satisfaction with SMS reminders and the effect of SMS reminders on willingness to perform exercises). The first question was assessed on a four-point Likert scale (very satisfied, satisfied, not satisfied, not satisfied at all)

Data Collection
Patients who will undergo pulmonary lobectomy are routinely admitted to the ward 1 day before surgery. In this context, patients were informed about the investigator 1 day before the operation, and their written consent was obtained. Patients were informed by the investigator about breathing exercises, how to perform coughing exercises, and the use of triflow within the scope of the routine procedures of the ward. It was confirmed that the patients performed all exercises correctly. The information form was filled by the face-to-face interview method. The contact number of the patients in the SMS group was recorded.
In postoperative routine care, the status of implementation of respiratory cough exercises in all patients was questioned during treatment and care hours and doctor visits. Same care teams involved in care of both groups.

A postoperative exercise follow-up chart was given to the patients. According to the patient's request, it was either pasted on the wall of the patient's room or left on the patient's bedside table with a pen. The patient was asked to record the requested information about each exercise day by day in the appropriate time zone. The chart was taken from the patients on the morning of the 5th postoperative day. In addition, the team (surgeon, resident physicians and nurses) questioned all patients about the implementation of respiratory cough exercises in routine postoperative care and the exercises performed by all patients were checked not only with the chart but also during nurse care practices and physician visits.

SMS group
On postoperative day 1, the patient's numerical pain score (average of the highest and lowest pain scores) and other information were recorded on the postoperative patient evaluation form.

Patients received a reminder SMS from the researcher's personal phone 3 times a day (08:00 after breakfast, 13:00 after lunch and 19:00 after dinner) starting from the 1st postoperative day, emphasizing the importance of exercise practices and that they should apply them (Dear Xname Xsurname, We remind you that you should apply the breathing exercises taught to you. The exercises help your lungs expand, fill with more oxygen, remove phlegm, and help you breathe more easily. Get well soon.) SMS sending started on day 1 and continued days 2, 3 and 4. In total, 12 messages were sent to the patients for 4 days. On the morning of the 5th postoperative day, patients were asked questions in the Patient Satisfaction Form.

Control Group
Patients in the control group did not receive any SMS within the scope of the study. In routine postoperative care, patients are encouraged to do breathing and coughing exercises during physician and nurse visits.

Primary and Secondary End Points of Study
Evaluating the impact of sending SMSs on after surgery exercises compliance in patients undergoing lobectomy surgery was the main goal of the study.

Evaluating the impact of sending SMSs on pain and patient satisfaction during lobectomy surgery was the study's second goal.

Data Analysis

The software SPSS 22.0 (SPSS, Inc., Chicago, IL, USA) was used to analyze the data. descriptive statistics (mean, frequency, percentage, standard deviation) were used to express the collected data. The Shapiro-Wilk normality test is used to determine whether the data exhibit a normal distribution. The Independent sample t-test, Pearson chi-square, and Mann Whitney U test were used to compare the groups. The accepted statistical significance threshold was set at $p<0.05$.

Ethical Permission

This study was approved by Ethics Committee of the Trakya University Medical Faculty Non-invasive Scientific Research (TUMFUMF-NSREC 2021/526, decision no: 01/03_03.01.2022) and by hospital directory. Prior to the study, the patients gave written consent, and the researcher explained the study.

Results

The mean age of the patients was 62.9±8.1 years and most of them were male participants (80.6%). Age, gender, and education characteristics of the patients were similar (Table 1). All patients underwent lobectomy. All patients had 2 thoracic tubes after thoracotomy.

It was determined that the mean number of breath exercises on the 4th postoperative day was statiscally significantly higher in the SMS group than in the control group (19.6±1.8 versus

Table 1. Patients' characteristics (n=62)

Characteristics	SMS group (n=31)	Control group (n=31)	Value of statistical
Age (year) (Mean ± SD)	58.9±13.2	56.2±11.3	p=0.126 t=2.365
Gender			p=0.335 X^2=1.653
Female	8 (25.8)	4 (12.9)	
Male	23 (74.2)	27 (74.2)	
Education			p=0.303 X^2=1.062
Primary/middle school	21 (67.7)	17 (54.8)	
High school	8 (25.8)	11 (35.5)	
University	2 (6.5)	3 (9.7)	
Comorbidity			p=0.434 X^2=1.088
Yes	14 (45.2)	10 (32.3)	
No	11 (35.5)	21 (67.7)	
Smoking			p=0.534 X^2=0.876
Yes	23 (74.2)	26 (83.9)	
No	8 (25.8)	5 (16.1)	
Analgesia			p=0.127 X^2=0.068
Epidural+combine	10 (32.3)	4 (12.9)	
Duragesic+combine	21 (67.7)	27 (87.1)	
Operation duration (minute) (Mean±SD)	173.5±44.1	181.4±44.9	p=0.489 U=431.500
Body mass index (kg/m²) (Mean±SD)	25.8±5.2	27.5±5.7	p=0.061 U=347.500

n: Number of the patient; SD: Standard deviation; t: Independent sample t test; U: Mann-Whitney U test; χ2: Chi-Square test

Table 2. Differences in exercises among the groups (n=62)				
Postoperative day	**Variables**	**SMS group n (31)**	**Control group n (31)**	**Value of statistical**
		(Mean± D)		
1st day	Mean number of breathing exercises	15.0±3.3	13.9±3.6	p=0.213 U=392.500
4th day		19.6±1.8	18.6±1.7	p=0.024 U=321.000
1st day	Mean number of coughing exercises	15.1±3.4	13.7±3.6	p=0.102 U=365.000
4th day		19.7±1.7	18.4±1.7	p=0.005 U=280.000
1st day	Mean number of triflow exercises	0.7±0.4	0.5±0.5	p=0.292 U=418.500
4th day		1.3±0.6	1.2±0.5	p=0.449 U=428.500
SD: Standard deviation; U: Mann-Whitney U test				

Table 3. Differences in pain scores among the groups (n=62)				
Postoperative day	**Pain score**	**SMS group n=31**	**Control group n=31**	**Value of statistical**
1st day	VAS (Mean±SD)	5.1±1.0	5.4±1.0	p=0.288 U=406.000
4th day	VAS (Mean±SD)	2.3±0.6	2.7±0.5	p=0.005 U=288.000
SD: Standard deviation; U: Mann-Whitney U test, VAS: Visual analog scale				

18.6±1.7) ($p<0.05$). Similarly, it was determined that the mean number of coughing exercises on the 4th postoperative day was statiscally significantly higher in the SMS group than the control group (19.7±1.7 versus 18.4±1.7) ($p<0.05$) (Table 2).

Pain scores were lower in the SMS group than the control group on the 4th postoperative day (2.3±0.6 versus 2.7±0.5) ($p<0.05$) (Table 3).

The vast majority of patients (87.1%) stated that they were "very satisfied" or "satisfied" with receiving reminder SMS. In the SMS group, 87.1% of the patients stated that SMS provided an incentive to exercise (Table 4).

Table 4. Satisfaction and incentive in the SMS Group (n=31)	
Satisfaction	SMS group n (%)
I am very satisfied	13 (41.9)
I'm satisfied	14 (45.2)
I was not satisfied	4 (12.9)
I was not satisfied at all	0 (0.0)
Incentive	
Yes	27 (87.1)
No	4 (12.9)

Discussion

In the study, it was determined that SMSs improved postoperative patients' participation in breathing and coughing exercises. In the study of Ghio et al. two text messages were sent to patients undergoing surgery (laporotomy, thoracotomy, laparoscopic/thoracoscopic surgery) and it was determined that text messages improved postoperative mobilization of patients and the use of incentive spirometry (12). Ghio et al. determined that text messages (Tulane STAR) promoting compliance with protocols after bariatric surgery improved

patients' fluid consumption, use of incentive spirometry, ambulation frequency, and distance. In another study, text messages improved ambulation in surgical patients (5). Eltorai et al. stated that incentive spirometer reminder (reminder bell) has been reported to improve patient compliance after coronary artery bypass graft (14). In patients undergoing endoscopic retrograde cholangiopancreatography, reminder SMSs have been shown to improve compliance with postoperative protocols (stent removal/replacement time) (15). In another study, it was determined that patients who underwent arthroplasty surgery and received text messages exercised more daily (16). As a result, the use of reminder messages sent via mobile phones is recommended to increase compliance with postoperative protocols.

In a study examining the effect of SMSs for pain management, Kevin et al. reported that patients who received text messages after arthroplasty surgery stopped opioid drug use 10 days earlier than patients receiving standard care (11). In this study, patients were not sent SMS for pain, but pain scores on the 4th postoperative day were found to be lower in the SMS group than in the control group. However, we think that the difference between the groups in the pain levels of the patients was not due to intervention alone. More application of deep breathing and coughing exercises in the SMS group may have contributed to the decrease in pain scores. The literature reports that breathing and coughing exercises are effective in pain control (17,18). Increased adherence to the exercises by SMSs may have partially helped to reduce the pain of the patients. Most patients (87.1%) stated that they were "very satisfied" or "satisfied" with receiving reminder SMS. Day et al. found that an automated SMS text program improved patient satisfaction after total joint arthroplasty (19,20). A systematic review revealed that the use of SMS improves patient satisfaction with postoperative pain management (19). Hallet et al. reported that 95.9% of patients were satisfied with receiving SMS for preoperative instructions (21), while another study found that 74% of patients undergoing pulmonary resection found the guidance of the Seamless MD mobile application (personalised reminders, task lists, etc.) useful (13). It can be argued that SMSs increase the satisfaction of surgical patients.

Limitations

The study population consisted of patients who underwent lobectomy for lung cancer. Therefore, it cannot be generalized to all patients undergoing thoracic surgery. However, its strengths can be listed as follows. Firstly, the results of the patients are the product of a 4-day follow-up. The long-term results of SMS reminders in patients can also be evaluated in the home after discharge. Secondly, the compliance of the control group with the exercises may have been positively affected since the team (surgeon, assistant physicians and nurses) questioned all patients about the implementation of respiratory cough exercises in postoperative routine care. Thirdly, the fact that the SMS was known by the patients did not make blinding possible. Fourthly, it is thought that the difference between the groups in the pain scores on the 4th postoperative day is due to the effect of other pain relief factors that were not examined in the study, other than exercise compliance.

Hawthorne Effect was limited in the study because the exercises performed by all patients were controlled not only with the chart but also during nurse care practices and physician visits. In addition, the researcher who performed the SMS sending was not included in the data collection process.

Conclusion

Patients having pulmonary lobectomies showed increased compliance with postoperative breathing and coughing exercises when using SMS. It may be useful for surgical nurses to send SMS reminders to patients to ensure patient compliance with postoperative pulmonary rehabilitation practices. The effects of being supported with multimedia methods in increasing the compliance of the patients with the postoperative protocols should be revealed. In future studies, the effect of the increase in exercise practices provided by SMS reception on secondary outcomes (development of complications, duration of hospitalisation, etc.) can be evaluated.

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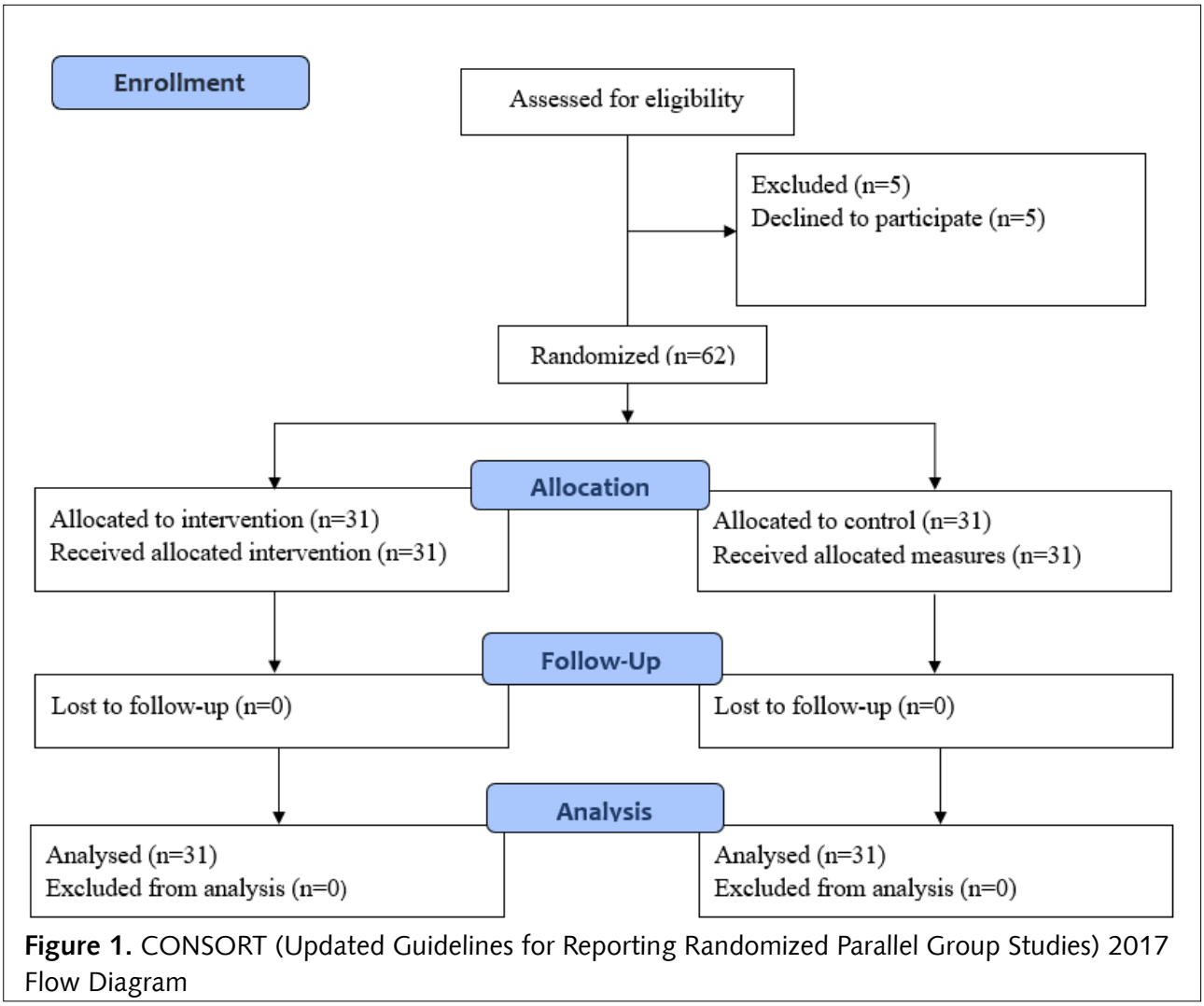

Figure 1. CONSORT (Updated Guidelines for Reporting Randomized Parallel Group Studies) 2017 Flow Diagram

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