

Effect of perioperative “Internet + rehabilitation guidance” based on IKAP theory on short-term prognosis of patients with esophageal cancer

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Abstract. – OBJECTIVE: The aim of the study was to investigate the “Internet + rehabilitation guidance” under the theory of Information-Knowledge-Attitude-Practice (IKAP) in patients with esophageal cancer during the perioperative period and to analyze the influence on the short-term prognosis of patients with esophageal cancer.

PATIENTS AND METHODS: From April 2022 to February 2023, 118 patients who underwent radical esophagectomy in the First Hospital of Huai'an Affiliated Hospital of Nanjing Medical University were enrolled using the convenience sampling method. They were divided into the IKAP group (59 cases) and the Control Group (Group C) (59 cases), according to the random number table method. The conventional intervention was performed during the perioperative period, and the IKAP group was also given “Internet + rehabilitation guidance” based on IKAP theory. The first postoperative defecation time, exhaust time, feeding time, discharge time, and postoperative complication rate of the two groups were compared. Meanwhile, blood samples were collected before surgery and 1, 3, 7, and 30 days after surgery (at outpatient review) for the detection of inflammatory factor indexes and nutritional indexes.

RESULTS: Patients within the IKAP group showed a shorter first postoperative exhaust and defecation time, eating time, and hospital compared to the control group ($p < 0.05$). Before surgery, there was no significant difference in serum inflammatory factors and nutritional indexes between the two groups ($p > 0.05$). Comparing the levels of serum inflammatory factors in the two groups after surgery, the levels of CRP and IL-6 in the IKAP group were lower than those in the control group on days 1, 3, and 7 after surgery. After 30 days, the serum CRP level was found to be lower than the control group, but no statistical difference with the control level of serum IL-6 ($p < 0.05$) was found. Compared with the serum nutritional index levels in the two

groups: 1 d after surgery, the serum HGB, PA, and TRF levels were not different ($p > 0.05$). The serum ALB level in the IKAP group was higher than that in the control group ($p < 0.05$). Postoperative 3 d, 7 d, the serum levels of HGB, ALB, PA, and TRF in the IKAP group were higher than those in the control group ($p < 0.05$). After 30 d, there was no statistical difference in serum HGB levels between the two groups ($p < 0.05$); Serum ALB, PA, and TRF levels in the IKAP group were higher than those in the control group ($p < 0.05$). From preoperative to 30 days after surgery, serum CRP and IL-6 levels in 2 groups were first increased and then decreased, while serum HGB, ALB, PA, and TRF levels were first decreased and then increased. After surgery, the IKAP group showed a greater incidence of complications in patients than in controls ($p < 0.05$).

CONCLUSIONS: In patients with esophageal cancer, perioperative “Internet + rehabilitation guidance” based on IKAP theory can effectively shorten the postoperative gastrointestinal function recovery time and rapidly reduce the inflammatory response, improving the nutritional status of the body, thereby reducing the risk of short-term postoperative complications.

Key Words:

Esophageal carcinoma, Perioperative period, IKAP theory, “Internet Plus”, Rehabilitation guidance, Short-term prognosis.

Introduction

Esophageal cancer, a kind of malignant tumor of the digestive system which occurs frequently in middle and old age males, has a high incidence in our country, ranking sixth among other malignant tumors. In addition, the prognosis of patients is poor, and the 5-year survival rate is only 10-30%^{1,2}. Surgery is the main method for

the clinical treatment of esophageal cancer. However, due to the complex anatomical structure of the esophagus and its proximity to the lungs, surgical treatment for esophageal cancer patients is more difficult, and the risk of lung infection is higher³. Meanwhile, patients with esophageal cancer still have serious negative emotions in the face of their own serious disease and surgical operation, which affects the prognosis. Therefore, perioperative nursing of patients with esophageal cancer needs to consider many aspects to meet their nursing needs in clinical treatment. Information-knowledge-attitude-practice (IKAP) intervention is a nursing theoretical model combining information, knowledge, belief and behavior, which has the application effect of improving the treatment compliance of clinical patients and improving the adverse mental state. Today, with the continuous development of Internet technology, the combination of clinical nursing work and “Internet +” technology makes nursing work out of the limitation of time and space but also increases the diversity of nursing work forms so that the nursing effect has been significantly improved. To improve the postoperative prognostic effect of patients with esophageal cancer, “Internet + rehabilitation guidance” is implemented based on the theoretical framework of IKAP in this study, and satisfactory intervention results are obtained as follows:

Patients and Methods

Sample Size Calculation

The sample size was calculated by way of pre-experiment, and 30 patients with esophageal cancer were included before the study. Routine treatment and perioperative nursing intervention were carried out to calculate the incidence of postoperative complications. Pre-experimental results show that the incidence of postoperative complications in 30 patients with esophageal cancer was 33.33% (10/30). By statistical calculation and analysis, compared with the pre-experimental results, the incidence of postoperative complications is controlled at a minimum of 10.00% to produce statistical significance. In other words, a valuable clinical study can be obtained if the incidence of postoperative complications of 30 patients with esophageal cancer is not higher than 10.00% after nursing intervention. The minimum number of included samples was calculated by the formula

$$n_1 = n_2 = \frac{2(\mu_\alpha + \mu_\beta)^2 p(1-p)}{\delta^2}$$

combined with the pre-experimental results. Among them, n_1 and n_2 represent the number of included samples in the two groups, respectively; μ_α and μ_β are the μ values corresponding to Class I and Class II error probabilities, respectively. p represents the average positive rate (in this study, the incidence of postoperative complications); δ represents the difference in positive rates. In this study, $\alpha=0.05$, $\beta=0.10$, and refer to the table $\mu_\alpha=1.6449$, $\mu_\beta=1.282$ (unilateral). The preliminary experimental results show that $p=(0.1+0.3333)/2=0.21665$, $\delta=0.3333-0.1=0.2333$. After inserting the formula

$$n_1 = n_2 = \frac{2(1.6449+1.282)^2 \times 0.21665(1-0.21665)}{0.2333^2} \approx 53$$

, considering the shedding rate of 10%, a minimum of 59 cases were calculated for each group, and 118 cases were eventually included.

General Information

From April 2022 to February 2023, 92 patients who underwent radical esophagectomy in the First Hospital of Huai'an Affiliated Hospital of Nanjing Medical University were enrolled by convenience sampling method. They were divided into the IKAP group (59 cases) and the control group (59 cases), according to the random number table method. Inclusion criteria: (1) Esophageal cancer was confirmed by pathological examination, meeting the staging requirements of squamous cell carcinoma below stage III and adenocarcinoma below stage IIb in AJCC/UICC stage (8th edition)⁴; (2) Age: 18-75 years old; (3) Ability to take action; (4) Preoperative examination excluded distant metastasis, which was consistent with the characteristics of radical operation; (5) Patients or their primary caregivers could carry out Internet-related activities through smartphones; (6) Having normal communication skills; (7) Having basic reading and writing ability and normal cognitive function, and can read and sign informed consent by themselves.

Exclusion criteria: (1) Combined with other malignant tumors or having malignant tumors; (2) Preoperative radiotherapy and chemotherapy; (3) Patients with recurrent esophageal cancer; (4) Complicated with other digestive tract diseases; (5) Preoperative complications of metabolic diseases, serious cardiovascular and cerebrovas-

cular diseases, or incomplete clinical data; (6) More than 7.5% weight loss occurred in the three months before surgery. Criteria for removal or stripping: (1) Serious complications after surgery, sent to ICU for monitoring and treatment; (2) Unplanned discharge; (3) Transferred to other departments or hospitals for treatment due to disease development or other factors; (4) Death; (5) Voluntarily withdraw from the study or fail to receive follow-up on time. There was no significant difference in general data between the two groups ($p>0.05$) (Table I).

Research Methods

Control group

Routine nursing was performed during the perioperative period, including recording patient information and monitoring vital signs after admission. Preoperative operation and disease-related health education guidance for patients to understand the psychological state of patients with abnormal psychological emotions for the implementation of psychological counseling. Post-operative catheter and incision nursing interventions were provided for patients in hospital, and precautions and dietary guidance were provided for patients at home before discharge.

IKAP

On the basis of routine perioperative nursing, "Internet + rehabilitation guidance" based on IKAP theory was implemented. The methods were as follows:

(1) The IKAP research group was led by the researcher. The researcher acted as the group leader, controlled the research direction and development process, searched clinical data, and formulated specific intervention plans based on their own experience. In addition, the team also included one head nurse who was responsible for evaluating the feasibility of the intervention plan, improving and supplementing the intervention plan, and regulating and supervising the work of clinical nursing staff to ensure the smooth progress of the research and effective implementation of the intervention plan; 6 nurses at N2 level or above, responsible for implementing clinical plans, collecting patient information, implementing clinical data statistics, etc. Before the intervention, the researchers invited medical staff with IKAP theoretical intervention, "nursing network +" intervention and rehabilitation guidance clinical research

experience to train the team members. After the training, the training results were assessed by written test and practical demonstration. Clinical research could only be carried out if the training results were qualified.

(2) The IKAP team jointly developed the intervention plan. According to the IKAP model, nursing was divided into four aspects: mastering information, imparting knowledge, establishing belief, and changing behavior. According to the time sequence, nursing was mainly divided into three periods: pre-operation, post-operation and staying at home. The nursing flow chart was formed after the combination (Figure 1).

(3) "Internet + health guidance" in preoperative IKAP mode. 1. Master the information. The IKAP research team designed a general information questionnaire, including name, gender, age, etc., generated two-dimensional code, and pasted it on the wall of the ward and the wall near the nurse's desk. After the patient was admitted to the hospital, the team members instructed the patient or their family members to scan the QR code using the mobile phone WeChat and inform them to fill in the QR code by themselves. If they had any questions, they could ask the nursing staff at the nurse's desk. After the patient's family members filled in the questionnaire, the nursing staff collected the questionnaire from the background and checked the content with the patient to ensure the accuracy of the patient's information. Meanwhile, personal files were established according to the clinical data and questionnaire results of patients. 2. Impart knowledge. The use of Internet technology, through the WeChat platform, to establish knowledge transmission channels. IKAP team members guided patients to follow the public account of our hospital, guided them to find the section on esophageal cancer in the undergraduate department through the public account of our hospital, and guided them to learn to read relevant articles through the public account. Meanwhile, the research team invited medical staff in the department to write health education articles and publish them in the public account on time (1-3 articles per week). Then, WeChat accounts of patients and their family members were added, photos related to the operating room were distributed to patients through WeChat, and surgical procedures were explained to patients according to the photos to

Table I. Comparison of general data between the two groups ($\bar{x} \pm s$).

Item		IKAP (n = 59)	Group C (n = 59)	χ^2/t	<i>P</i>	Item		IKAP (n = 59)	Group C (n = 59)	χ^2/t	<i>P</i>
Gender	Male	43 (72.88)	39 (66.10)	0.640	0.424	Pathologic staging	I	6 (10.17)	4 (6.78)	1.470	0.689
	Female	16 (27.12)	20 (33.90)				II	33 (55.93)	36 (61.02)		
Age (years)		61.59±7.73	60.95±8.53	0.427	0.670		III	18 (30.51)	15 (25.42)		
Marital status	Unmarried	2 (3.39)	0 (0.00)	3.452	0.178		IV	2 (3.39)	4 (6.78)		
	Married	51 (86.44)	55 (93.22)			Histological type	Squamous cell carcinoma	35 (59.32)	30 (50.85)	0.856	0.355
	Divorced/ widowed	8 (13.56)	4 (6.78)				Adenocarcinoma	24 (40.68)	29 (49.15)		
Degree of education	Primary school and below	39 (66.10)	33 (55.93)	1.633	0.442	Surgical method	Thoracotomy	41 (69.49)	38 (64.41)	0.484	0.785
	Middle school to high school	14 (23.73)	16 (27.12)				Cavity mirror	13 (22.03)	14 (23.73)		
	College degree or above	6 (10.17)	10 (16.95)				Thoracotomy + endoscope	5 (8.47)	7 (11.86)		
Annual household income	< 30,000 yuan	16 (27.12)	20 (33.90)	0.789	0.674	Medical expenses settlement method	At one's own expense	12 (20.34)	16 (27.12)	1.477	0.478
	30,000-50,000 yuan	35 (59.32)	33 (55.93)				Employee medical insurance	22 (37.29)	24 (40.68)		
	> 50,000 yuan	8 (13.56)	6 (10.17)				Rural cooperative medical care	25 (42.37)	19 (32.20)		
Focal location	Middle upper segment	5 (8.47)	7 (11.86)	1.940	0.585						
	Middle segment	16 (27.12)	11 (18.64)								
	Middle and lower segment	2 (3.39)	4 (6.78)								
	Lower segment	36 (61.02)	37 (62.71)								

IKAP: IKAP group; Group C: control group.

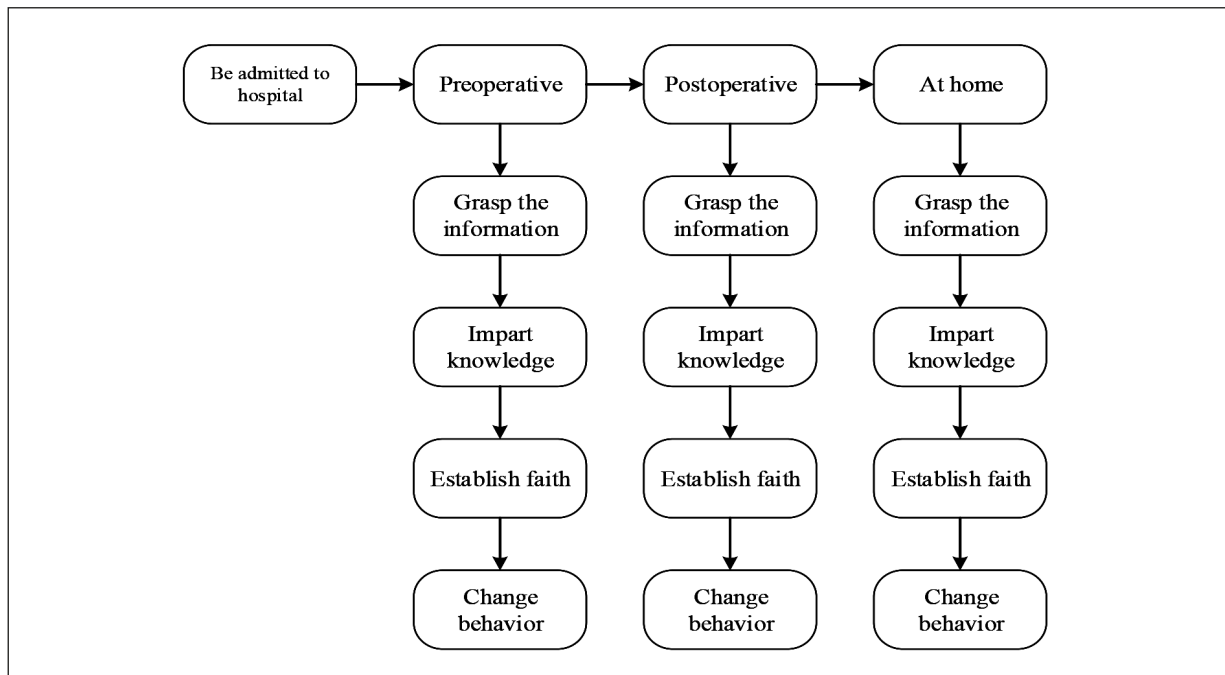


Figure 1. Preoperative flow chart of “Internet + health guidance” in IKAP mode.

reduce their fear caused by unfamiliar surgical procedures. Finally, from 10:30 am to 11:30 am every Monday and Wednesday, undergraduate medical staff were invited to give health lectures. Clinicians mainly focused on esophageal cancer, radical operation, postoperative chemoradiotherapy, and other content to explain. The nursing staff mainly focused on the perioperative preparation, precautions, self-care skills after discharge, and other aspects of the explanation. 3. Establish faith. Specific measures included communicating with patients before surgery, evaluating their psychological state, guiding them to engage in positive psychological construction, and establishing a necessary belief in the success of the surgery. 4. Change behavior. It was essential to ensure adequate sleep and a regular diet before the operation and assist in bowel preparation according to operation requirements.

(4) “Internet + health guidance” in IKAP mode after surgery. 1. Master the information. According to the patient’s postoperative situation, the patient’s personal file was supplemented, and the physiological index monitoring was taken as the main content to master the information, in order to fully understand the patient’s body recovery. Patients with good recovery could see the recorded information

and explain the improvement of their condition according to the recorded information, so as to increase their confidence in the prognosis. 2. Impart knowledge. Post reminders of postoperative precautions to patients and their families were sent through WeChat to enhance the awareness and cognition of patients and their families on common complications as much as possible and reduce the risk of complications to the greatest extent. 3. Establish faith. A WeChat group was established through the WeChat platform to bring postoperative esophageal cancer patients into the group, increase communication between patients, and reduce the impact of loneliness on patients’ mental health. Meanwhile, patients who had recovered well were encouraged to share their own experiences, so as to establish positive recovery beliefs for other patients. 4. Change behavior. After patients were able to get out of bed, they were encouraged to carry out certain exercises under the condition of body tolerance, such as walking in the corridor of the ward, up and down the stairs, etc. In addition, patients were reminded to go to bed on time, establish good rest and rest time, and push dietary guidance through WeChat after patients resumed oral administration.

(5) “Internet + Health guidance” in IKAP mode at home. 1. Master the information. After the patient was discharged from the hospital, he/she was asked about his/her recent sleep, diet, defecation, drinking water, and other conditions through WeChat every week, as well as his/her body feelings and the inquiry results were recorded in his/her personal file. 2. Impart knowledge. Continuously send health education articles through the WeChat public account and WeChat one-on-one. The articles mainly focused on self-care skills and complications self-monitoring skills during the stay at home, so as to improve patients’ self-care ability during the stay at home. 3. Establish faith. In the WeChat group, patients were encouraged to organize collective activities and go outdoors to improve their positive beliefs in daily life by feeling the social support and the beauty of nature. 4. Change behavior. For patients with poor work and rest habits and eating habits, the harm of bad living habits was explained through WeChat one-on-one voice, so as to improve their bad living habits.

Quality control

Before the study, medical personnel with clinical research experience were consulted to evaluate the scientific feasibility of the intervention plan, and adjustments were made. During the study, communication with patients was continuously strengthened through WeChat voice and video to ensure their compliance with the study. A research quality control group was established, consisting of one deputy chief physician and two deputy chief nurses in the department of oncology. The progress of the study and the work of IKAP team members were checked from time to time to ensure that the experimental operation was carried out according to the plan.

Observation Indicators

Clinical outcome indicators

The first postoperative defecation time, exhaust time, feeding time, and discharge time were counted.

Laboratory inspection indicators

Before surgery and 1, 3, 7, and 30 days after surgery (at the time of outpatient review), patients’ blood was collected and sent to the laboratory for the detection of blood-related indicators. The detection indexes included two parts: inflammatory factors [C-reactive protein (CRP), interleukin-6 (IL-6)] and nutritional indexes [hemoglobin (HGB), albumin (ALB), prealbumin (PA), and transferrin (TRF)].

Postoperative complications

The incidence of pulmonary infection, intestinal obstruction, and other complications within 30 days after operation were counted.

Statistical Analysis

SPSS 22.0 was applied for statistical analysis (IBM Corp., Armonk, NY, USA). Statistical data were represented by n and %, and the χ^2 test was performed. A normal distribution test was carried out for measurement data, and () was used to indicate conformity with normal distribution. An Independent sample *t*-test was used between groups. A paired *t*-test was used in the group; the non-conforming distribution was represented by [M (Q1, Q2)], and the Kruskal-Wallis’ rank sum test was performed. *p*<0.05 showed a statistically significant difference.

Results

Comparison of Postoperative Clinical Outcome Indicators

In Table II, the IKAP group of patients with postoperative first exhaust and defecate, eating time, and hospital stay were shorter than the control group (*p*<0.05).

Comparison of Blood Test Indexes in Different Time Periods

Before surgery, there was no significant difference in serum inflammatory factors and nu-

Table II. Comparison of postoperative clinical outcome indexes between the two groups ($\bar{x} \pm s$).

Index	IKAP (n = 59)	Group C (n = 59)	t	p
First exhaust time (h)	46.58 ± 6.01	68.86 ± 5.13	21.658	0.000
First defecation time (h)	50.07 ± 4.14	55.37 ± 3.69	7.341	0.000
First feeding time (d)	5.31 ± 1.28	7.24 ± 1.65	7.099	0.000
Length of hospital stay (d)	10.05 ± 2.18	12.36 ± 3.61	4.207	0.000

IKAP: IKAP group; Group C: control group.

tritional indexes between the two groups ($p > 0.05$). Compared with the levels of serum inflammatory factors between the two groups after surgery, the levels of CRP and IL-6 in the IKAP group were lower than those in the control group on days 1, 3, and 7 after surgery. After 30 d, the serum CRP level was lower than in the control group, but there was no statistical difference with the control level of serum IL-6 ($p < 0.05$). After surgery, the serum nutritional indexes of the two groups were compared: 1 day after surgery, the serum HGB, PA, and TRF levels of the two groups were not statistically significant ($p > 0.05$); the IKAP patient's serum propagated level was higher than Group C ($p < 0.05$). Postoperative 3 d, 7 d, IKAP patients' serum HGB, ALB, PA, and TRF levels were higher than levels in Group C ($p < 0.05$). After 30 d, two groups of serum levels of HGB showed no statistical difference ($p > 0.05$); IKAP patients' serum ALB, PA, and TRF levels were higher than those in the control group ($p < 0.05$, Table III) for details. From preoperative to postoperative 30 days, serum CRP and IL-6 levels in 2 groups were firstly increased and then decreased and reached the peak on postoperative 3 and postoperative 1 day, respectively. Serum HGB, ALB, PA, and TRF levels decreased first and then increased (Figure 2a-2f).

Comparison of Postoperative Complication Rates Between the Two Groups

Postoperatively, the incidence of complications in patients in the total IKAP group was lower than in the control group ($p < 0.05$, Table IV).

Discussion

Esophageal cancer has a high morbidity and mortality worldwide, ranking seventh and sixth among other malignant tumors. Under normal circumstances, patients may experience progressive worsening of swallowing difficulties after onset, especially middle-aged and elderly men⁵⁻⁹. Surgery is still the main way to treat esophageal cancer in clinic. Although conventional thoracotomy is helpful for relatively comprehensive removal of lesions, large-scale surgical wounds also increase the risk of postoperative complications, especially related infections, resulting in prolonged postoperative body recovery time for patients¹⁰⁻¹². Although minimally

invasive techniques have been widely applied in McKeown radical resection of esophageal cancer, the surgical incision has been reduced to a large extent, and relatively good efficacy has been obtained, but it has also increased the difficulty and time of surgery¹²⁻¹⁴. Therefore, whether traditional surgery or minimally invasive surgery is selected, the patient's body will be damaged¹⁵. At this time, nursing work should be coordinated to alleviate the physiological and psychological emergency symptoms brought by surgery and disease.

With the development of Internet technology, "Internet +" nursing model has become the focus of clinical research. The application of this technology can not only ignore the barrier of time and place to a certain extent but also integrate video, and audio into nursing intervention, increasing the diversity of nursing modes. In addition, the IKAP nursing mode is also a relatively new nursing mode, which can increase the communication between nurses and patients, form inductive health guidance for patients, and increase their nursing cooperation. In this study, "Internet + rehabilitation guidance" was implemented in IKAP mode. The results showed that patients in the IKAP group had shorter first postoperative exhaustion, defecation, eating time, and hospital stay. The incidence of complications was lower within 30 days after surgery, indicating that this nursing model can improve the body recovery speed of patients with esophageal cancer in the short period after surgery. Meanwhile, serum CRP and IL-6 levels were lower in the IKAP group on day 1, day 3, day 7, and on day 30 after surgery, indicating that this nursing mode reduced the postoperative inflammatory response of patients. Compared with the control group, the serum ALB level of the IKAP group was higher 1 day after the operation. Serum levels of HGB, ALB, PA, and TRF were higher at 3 and 7 days after surgery. Serum ALB, PA, and TRF levels were also higher at 30 days after surgery. This nursing mode was helpful in improving the nutritional status of patients. As can be seen from Figures 2-7, the level of serum indexes in the IKAP group fluctuated lower, indicating that this nursing mode had the effect of stabilizing the physiological function of patients. It can be inferred that this was the reason why this nursing model had a positive effect on the short-term prognosis of patients with esophageal cancer after surgery.

Table III. Comparison of serum inflammatory factors and nutritional indexes between the two groups at different time periods ($\bar{x} \pm s$).

Index	Time	IKAP (n=59)	Group C (n=59)	t	p	Index	Time	IKAP (n=59)	Group C (n=59)	t	p
CRP (mg/L)	Preoperative	6.43±2.12	6.74±2.05	0.807	0.421	IL-6 (ng/L)	Preoperative	3.14±1.52	3.74±1.80	1.951	0.054
	Postoperative day 1	68.70±15.06	95.56±17.22	9.019	0.000		Postoperative day 1	189.35±25.19	238.10±26.80	10.181	0.000
	3 days after surgery	137.80±20.75	150.34±16.29	3.651	0.000		3 days after surgery	61.90±20.01	96.78±27.50	7.878	0.000
	7 days after surgery	50.99±9.24	64.59±12.52	6.713	0.000		7 days after surgery	29.64±8.58	54.56±14.59	11.309	0.000
	30 days after surgery	15.18±3.85	18.54±4.50	4.358	0.000		30 days after surgery	15.73±4.60	16.49±3.61	0.998	0.320
HGB (g/L)	Preoperative	135.28±17.58	139.37±24.10	1.053	0.295	ALB (g/L)	Preoperative	40.93±3.77	42.11±3.94	1.662	0.099
	Postoperative day 1	127.05±20.14	124.31±20.39	0.734	0.464		Postoperative day 1	35.77±3.42	33.09±3.50	4.207	0.000
	3 days after surgery	122.31±16.44	115.45±14.68	2.391	0.018		3 days after surgery	36.54±3.21	33.51±3.19	5.143	0.000
	7 days after surgery	117.98±18.34	110.37±12.07	2.662	0.009		7 days after surgery	38.59±3.58	34.81±5.00	4.721	0.000
	30 days after surgery	126.31±19.94	119.65±17.52	1.927	0.056		30 days after surgery	42.53±3.80	38.78±5.30	4.417	0.000
PA (mg/L)	Preoperative	291.69±64.78	297.87±60.85	0.534	0.594	TRF (g/L)	Preoperative	2.14±0.58	2.17±0.48	0.135	0.893
	Postoperative day 1	283.99±22.01	277.92±36.23	1.100	0.274		Postoperative day 1	1.75±0.51	1.64±0.41	1.291	0.199
	3 days after surgery	214.57±20.24	175.27±27.27	8.889	0.000		3 days after surgery	1.59±0.43	1.36±0.53	2.589	0.011
	7 days after surgery	218.57±24.98	192.28±21.44	6.134	0.000		7 days after surgery	1.49±0.44	1.29±0.54	2.205	0.029
	30 days after surgery	247.31±19.47	220.90±19.27	7.405	0.000		30 days after surgery	1.70±0.42	1.52±0.42	2.328	0.022

IKAP: IKAP group; Group C: control group; CRP: C-reactive protein; HGB: hemoglobin; PA: serum prealbumin; IL-6: Interleukin-6; ALB: serum albumin; TRF: transferrin.

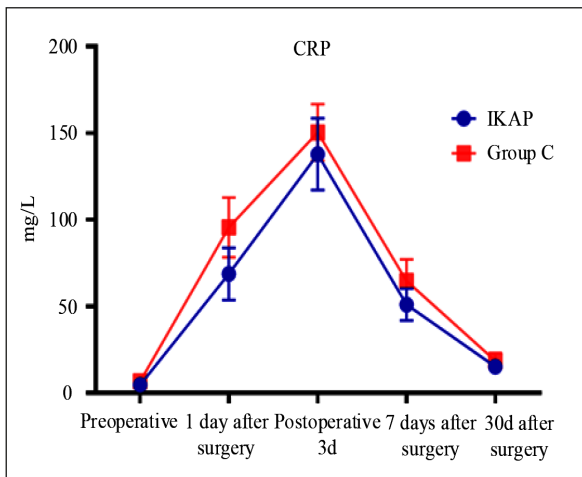


Figure 2. Serum CRP levels. IKAP: IKAP group; Group C: control group; CRP: C-reactive protein.

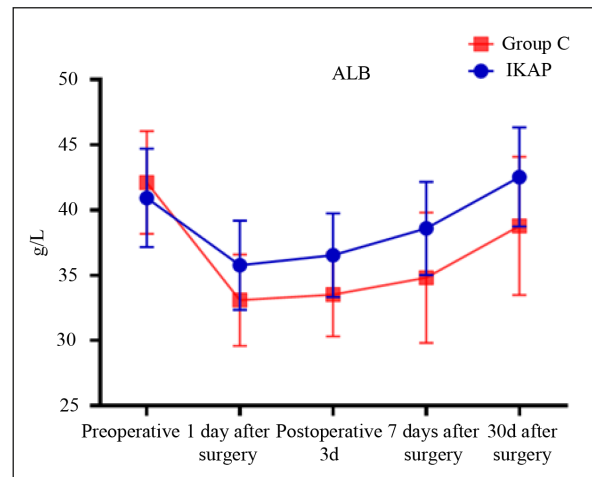


Figure 5. Serum ALB levels. IKAP: IKAP group; Group C: control group; ALB: serum albumin.

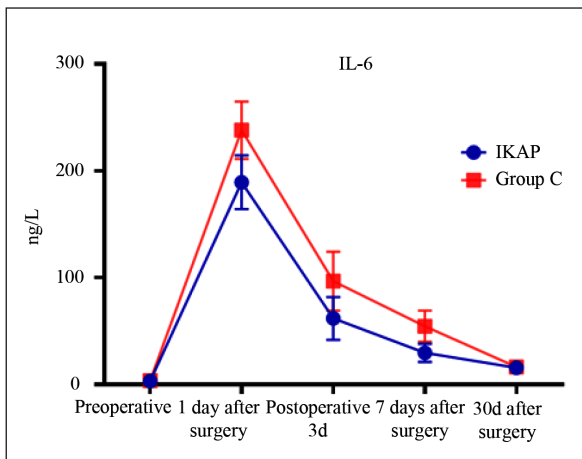


Figure 3. Serum IL-6 levels. IKAP: IKAP group; Group C: control group; IL-6: Interleukin-6.

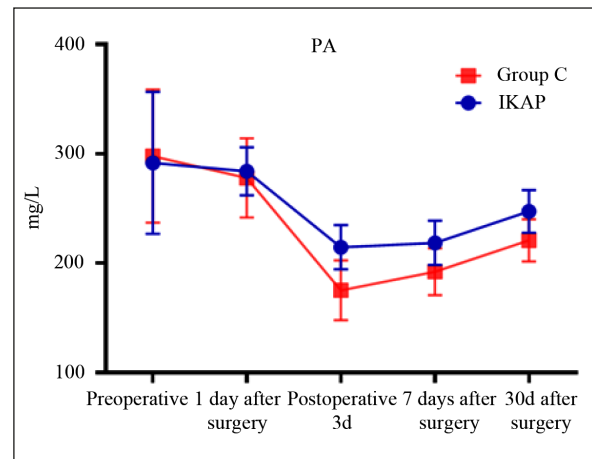


Figure 6. Serum PA levels. IKAP: IKAP group; Group C: control group; PA: serum prealbumin.

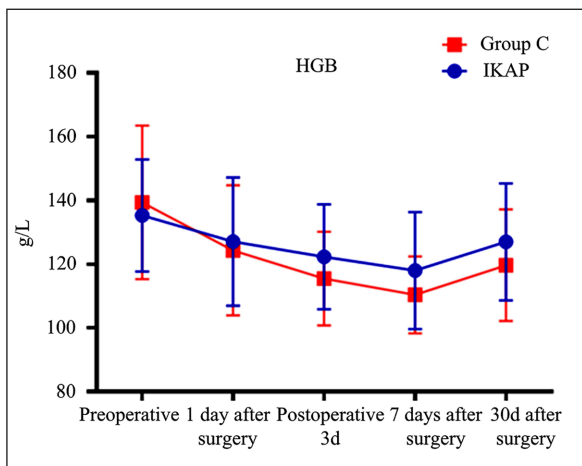


Figure 4. Serum HGB level. IKAP: IKAP group; Group C: control group; HGB: hemoglobin.

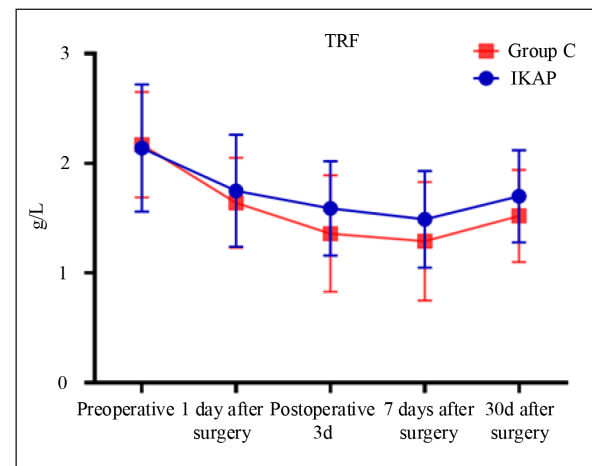


Figure 7. Serum TRF levels. IKAP: IKAP group; Group C: control group; TRF: transferrin.

Table IV. Comparison of postoperative complication rates between the two groups.

Index	IKAP (n = 59)	Group C (n = 59)	χ^2	P
Pulmonary infection	1 (1.69)	2 (3.39)	0.342	0.559
Anastomotic fistula	4 (6.78)	9 (15.25)	2.161	0.142
Incision infection	2 (3.39)	4 (6.78)	0.702	0.402
Chest infection	1 (1.69)	2 (3.39)	0.342	0.559
Anastomotic stricture	1 (1.69)	1 (1.69)	0.000	1.000
Reflux esophagitis	0 (0.00)	1 (1.69)	1.008	0.315
Total	9 (15.25)	19 (32.20)	4.683	0.03

IKAP: IKAP group; Group C: control group.

Conclusions

In summary, “Internet + rehabilitation guidance” based on IKAP theory is helpful in improving the short-term postoperative recovery speed of patients with esophageal cancer, reducing the incidence of postoperative complications, and improving the nutritional status of the body.

Conflict of Interest

The authors declare that they have no conflict of interest.

Ethics Approval

Ethics Committee approval was obtained from the Institutional Ethics Committee of The Affiliated Huaian No. 1 People’s Hospital of Nanjing Medical University (ethical number: NJ20220816).

Informed Consent

Written informed consent for publication was obtained from the participants.

Data Availability

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

Authors’ Contribution

JM, YC, QW, and YY prepared the manuscript, provided the study concept and design, and analyzed and interpreted the data. All authors read and approved the final version of the manuscript.

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