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Original Article

Effects of fast track surgery on perioperative recovery, stress indicators and swallowing function in patients with thyroid cancer

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Abstract: Objective: To explore the effects of fast track surgery (FTS) on perioperative recovery, stress indicators and swallowing function in patients with thyroid cancer. Methods: One hundred and thirty patients with thyroid cancer admitted to Huzhou Central Hospital, Zhejiang University Huzhou Hospital, Affiliated Hospital of Huzhou Normal University from January 2019 to December 2020 were retrospectively included as study subjects, and were divided into a control group (n = 63, conventional nursing) and a study group (n = 67, FTS). The perioperative recovery indicators, complications, stress response, and swallowing function were compared between the two groups. Logistic regression analysis was used to analyze the risk factors for accelerating postoperative recovery. Results: No statistically significant differences were observed in the scores of Kubota drinking test and Ichiro Fujishima rating scale (IFRS) between the two groups before intervention ($P > 0.05$). After nursing, the study group had lower scores of Kubota drinking test and higher scores of IFRS than the control group ($P < 0.05$). The time to drainage tube removal, time to first anal exhaust, time to first getting out of bed activity, length of hospitalization, and medical costs in the study group were lower than those in the control group ($P < 0.05$). The study group showed lower incidence of postoperative complications than the control group (8.96% vs. 28.57%, $P < 0.05$). The postoperative C-reactive protein, glucose, epinephrine, cortisol levels and numerical rating scale scores in the study group were lower than those in the control group ($P < 0.05$). Logistic regression analysis showed that age was an important negative factor for accelerating postoperative recovery of patients with thyroid cancer, and the length of postoperative hospital stay increased significantly with age ($P < 0.05$). Conclusion: The intervention of FTS in the perioperative period for thyroid cancer patients can improve the swallowing function, shorten the recovery time and reduce the incidence of complications, which may be related to the improvement of the perioperative stress response of patients with FTS.

Keywords: Fast track surgery, thyroid cancer, perioperative nursing, recovery process, swallowing function, stress response

Introduction

Thyroid cancer (TC) is the most common endocrine tumor of the head and neck, with an annual incidence of 4% [1]. According to the data released by the National Cancer Institute (NCI) in 2020, thyroid cancer is the fifth most prevalent cancer among all types of cancers in women in the United States [2]. With the exhausting fast pace of life and increasing work pressure, the incidence of thyroid cancer is also on the rise in China, mainly affecting young people, with thyroid cancer ranking fourth in the incidence of cancer among women in China [3]. Thyroid cancer has become the most prevalent malignancy in women under the age of 30 [4].

Currently, surgical treatment is the main treatment option for thyroid cancer, and due to the low malignancy of thyroid cancer, most patients have a good prognosis after surgery, with a 5-year survival rate of 92.6% [5]. However, it has been found in clinical practice that in spite of a good prognosis, most patients with thyroid cancer still suffer from postoperative complications such as swallowing arrest, delayed swallow initiation, and hoarseness, which adversely affect the quality of life and work of patients to some extent [6, 7]. Fast-track surgery (FTS), a

concept first proposed by Wilmore and Kehlet in 2001, is a method to reduce surgical stress and accelerate postoperative recovery through a series of perioperative optimization measures, which has been proven to be effective by evidence-based medicine [8, 9]. FTS is currently used in a wide range of clinical settings and has been shown to play a positive role in the recovery process of patients with breast cancer and lung cancer [10, 11], but there are still few studies on FTS in improving perioperative stress indicators and postoperative rehabilitation of patients with thyroid cancer. The purpose of this study was to explore the value of FTS in improving the indicators of the perioperative rehabilitation of patients with thyroid cancer, and to provide clinical reference for improving the prognosis of patients with thyroid cancer.

Materials and methods

General data

One hundred and thirty inpatients with thyroid cancer admitted to Huzhou Central Hospital, Zhejiang University Huzhou Hospital, Affiliated Hospital of Huzhou Normal University from January 2019 to December 2020 were retrospectively included as study subjects, and were divided into a control group (n = 63, conventional intervention) and a study group (n = 67, FTS). This study was conducted with the approval of the Huzhou Central Hospital, Zhejiang University Huzhou Hospital, Affiliated Hospital of Huzhou Normal University Ethics Committee. All patients and their families signed the informed consent form at the beginning of the treatment, agreeing that their data can be used in further research.

Inclusion criteria: (1) all subjects included were diagnosed with thyroid cancer by pathological tests according to the Guidelines for the Treatment of Thyroid Cancer for diagnosis and treatment [12] and underwent surgical treatment; (2) their medical records were complete.

Exclusion criteria: (1) patients with psychiatric disorders; (2) patients with other concurrent malignancies; (3) patients with previous history of thyroid surgery; (4) patients with chemotherapy treatment; (5) patients with chronic diseases such as myocardial infarction, stroke and heart failure; (6) patients with severe liver and kidney dysfunction; (7) patients with Parkinson's and muscular sclerosis that affect the progress of research; (8) patients with distant metastases of cancer; or (9) patients with previous history of anxiety and depression.

Intervention method

Patients in the control group were given conventional perioperative intervention. Patients were instructed to fast for 12 h and refrained from drinking water for 6 h before surgery, and told to ensure they got sufficient sleep the night before surgery. Intraoperative fluid administration was not restricted, and insulation measures such as temperature-controlled blankets were not used. Patients were kept in a semi-recumbent position after the stabilization of postoperative vital signs, and they could drink warm water within 12 h after surgery and have a liquid diet after 24 h. Cardiac monitoring was generally cancelled and urinary catheters were removed 24 h after surgery, and patients were encouraged to move as soon as possible.

Patients in the study group were treated with FTS nursing on the basis of care given to the control group as follows: (1) Assignment of a professional nursing team. A professional nursing team was established, consisting of 2 doctors, 1 head nurse, 5 nurses, 1 dietician and 1 psychological counselor. The division of responsibilities was clearly defined to lay the foundation for the follow-up nursing. (2) Pre-operative intervention. Patients were warmly welcomed by nurses upon admission, and shown the hospital environment, and management requirements were introduced to patients, helping them and their families adapt to the hospital environment as soon as possible. Based on the analysis of the patient's medical records, the doctor explained the condition to the patient and their families, briefly introduced the surgical procedures so that they could correctly understand the disease and eliminate preoperative anxiety. For patients with excessive stress, sleeping pills could be taken the night before surgery to ensure sleep quality. Preoperative posture training was provided to patients to help them adapt to the intraoperative position in advance. Patients were instructed to quit smoking, reduce respiratory secretions, and perform respiratory function training during hospitalization. Patients fasted from food

and water for 6 h and 2 h before surgery, and were administered 200 mL of 10% glucose (Shanghai Baxter Healthcare Co., Ltd., Specification: 500 mL/bottle, Approval No. H19994-062) orally 2.5 h before surgery to reduce the hunger caused by prolonged fasting. (3) Intraoperative intervention. The operating room temperature was kept at 20-25°C and humidity at 50%-60%. The patient's intraoperative body temperature was closely monitored, and a temperature-controlled blanket was used for insulation treatment when the patient's body temperature was lower than 36°C. The shoulders of patients were elevated, and patients were kept in supine position with neck hyperextension to fully expose the thyroid gland and ensure the smooth operation. Intraoperatively, the amount of rehydration fluid was controlled and saline infusion was restricted. (4) Postoperative intervention. ① After the patient was awake from anesthesia and the vital signs were stable, a soft pillow was placed under the head and tail of the bed to prevent the patient from falling off the bed. Body position was adjusted to reduce the incidence of postoperative adverse symptoms such as head and neck pain, nausea and vomiting. ② After awakening from general anesthesia, patients were encouraged and assisted to turnover in bed and get out of bed for movement at 24 h after surgery. If there was no obvious discomfort after surgery, patients could drink warm water at 6 h and have liquid food at 12 h. To reduce the risk of wound bleeding, patients and their families were instructed not to eat overheated foods. ③ The care team paid attention to the patient's postoperative swallowing. Lingual resistance training was proposed as an intervention for the patient. A tongue muscle rehabilitation device was adopted to stimulate the oral cavity of patients, and neck massage was performed for those presented with weakness in laryngeal lifting, and frozen cotton swabs could be used to stimulate the tongue root, soft palate and posterior pharyngeal wall to speed up the patient's swallowing function recovery. ④ The drainage tube of the patient was fixed, and the patient and family members were instructed to prevent the drainage tube from toughing or falling off due to the patient turning and getting out of bed, etc. The color and flow of fluid in the drainage fluid was observed, and the attending doctor was contacted in real time to give treatment if there was any abnormality. Drug analgesia was administered 3 days after surgery to relieve pain.

Outcome measurements

Primary outcomes: (1) Swallowing function was assessed before and 7 d after intervention by using the Kubota drinking test and the Ichiro Fujishima rating scale (IFRS) [13]. In the Kubota drinking test, the patient drank 30 mL of warm water and swallowed it smoothly once as grade 1, swallowed twice without choking as grade 2, swallowed once but with choking as grade 3, swallowed twice or more with choking as grade 4, or was unable to drink all 30 mL of water with frequent choking during swallowing as grade 5. The IFRS has a range of 1-10 points, of which a score of 1-3 indicates severe dysphagia, a score of 4-6 indicates moderate dysphagia, and a score of 7-9 indicates mild dysphagia. A score of 10 indicates normal swallowing and a lower score indicates a higher degree of dysphagia. (2) Perioperative recovery indicators, including time to drainage tube removal, time to first anal exhaust time, time to first getting out of bed activity, length of hospitalization, and medical costs were recorded. (3) Perioperative stress indicators: blood samples were collected before surgery and at 24 h, 48 h, and 72 h after surgery. The blood samples of patients in both groups were collected, the C-reactive protein (CRP), glucose (GLU), epinephrine (E), and cortisol (Cor) levels in the blood samples were tested using an automatic biochemical analyzer, and each index was tested three consecutive times, with the average value as the final result. The pain level of the enrolled patients was also assessed at the above time points using the numerical rating (NRS) scale that consisted of a scale of 0-10, with 0 representing no pain and 10 representing the worst pain, and the patients were asked to rate the pain according to their own conditions.

Secondary outcomes: The incidence of various perioperative complications such as incisional infection, skin scarring, hoarseness, rostral nerve injury, and hypocalcemic convulsions were compared between the two groups. Logistic regression analysis was used to analyze the risk factors for postoperative recovery.

Statistical methods

Data were analyzed with the Statistical Package for Social Sciences (SPSS) 24.0 statistical software. Normality of quantitative data was tested by Kolmogorov-Smirnov test. For quantitative data conforming to normal distribution, data

Table 1. Comparison of general clinical indicators ($\bar{x}\pm s$)/[n (%)]

Baseline data		Control group (n = 63)	Study group (n = 67)	t/χ^2	*P*
Gender	Male	28	27	0.229	0.633
	Female	35	40		
Mean age (years)		49.19±7.21	50.30±6.89	0.050	0.963
BMI		22.15±2.15	22.21±1.98	0.166	0.869
Pathological type	Papillary carcinoma	46	43	1.174	0.279
	Follicular carcinoma	17	24		
Underlying disease	Hypertension	5	6	0.044	0.835
	Diabetes	4	3	0.223	0.637

BMI: Body Mass Index.

Table 2. Comparison of swallowing function ($\bar{x}\pm s$)

Group	Number of cases	Kubota drinking test		IFRS	
		Before nursing	After nursing	Before nursing	After nursing
Study group	67	3.68±0.54	1.44±0.14	6.41±0.54	9.84±1.21
Control group	63	3.71±0.48	1.89±0.18	6.51±0.48	8.74±0.98
t	-	0.334	15.964	1.113	5.674
P	-	0.739	< 0.001	0.268	< 0.001

IFRS: Ichiro Fujishima Rating Scale.

were described as mean ± standard deviation (SD), independent samples t-test was used for comparison between the two groups, analysis of variance (ANOVA) was used for multiple group comparisons, Student-Newman-Keuls (SNK) test was used for post hoc comparisons, two-way ANOVA was used for comparison of CRP, GLU, E, Cor levels and NRS scores before and after nursing, and repeated measures ANOVA was used to compare data at multiple time points. Qualitative data were expressed as n (%) and compared between groups using chi-square test. $P < 0.05$ indicated a significant difference and graphs were plotted using GraphPad Prism 8.0 [14].

Results

Comparison of general clinical indicators

The two groups of patients showed no statistical difference in terms of general clinical indicators such as gender, age, and type of pathology ($P > 0.05$), indicating comparability between the two groups (**Table 1**).

Comparison of swallowing function before and after intervention

No significant differences were observed in the Kubota drinking test and IFRS scores between the two groups before intervention ($P > 0.05$). After surgery, Kubota drinking test scores of patients in both groups were reduced, while the IFRS scores were increased compared to those before surgery ($P < 0.05$) with more significant alteration in the study group ($P < 0.05$) (**Table 2** and **Figure 1**).

Comparison of perioperative rehabilitation indicators

The time to drainage tube removal, time to first anal exhaust, and time to first getting out of bed activities in the study group were significantly shorter than those in the control group ($P < 0.05$). The length of hospitalization and medical costs of patients in the study group were also lower than those in the control group ($P < 0.05$) (**Table 3** and **Figure 2**).

Comparison of perioperative stress indicators

The preoperative CRP, GLU, E, and Cor levels were not statistically significant in both groups ($P > 0.05$). The postoperative CRP, GLU, E, and Cor levels were elevated in both groups, but they were significantly lower in the study group than in the control group ($P < 0.05$). The differences between the two groups in preoperative NRS scores were not statistically significant ($P > 0.05$); however, the NRS scores in the study

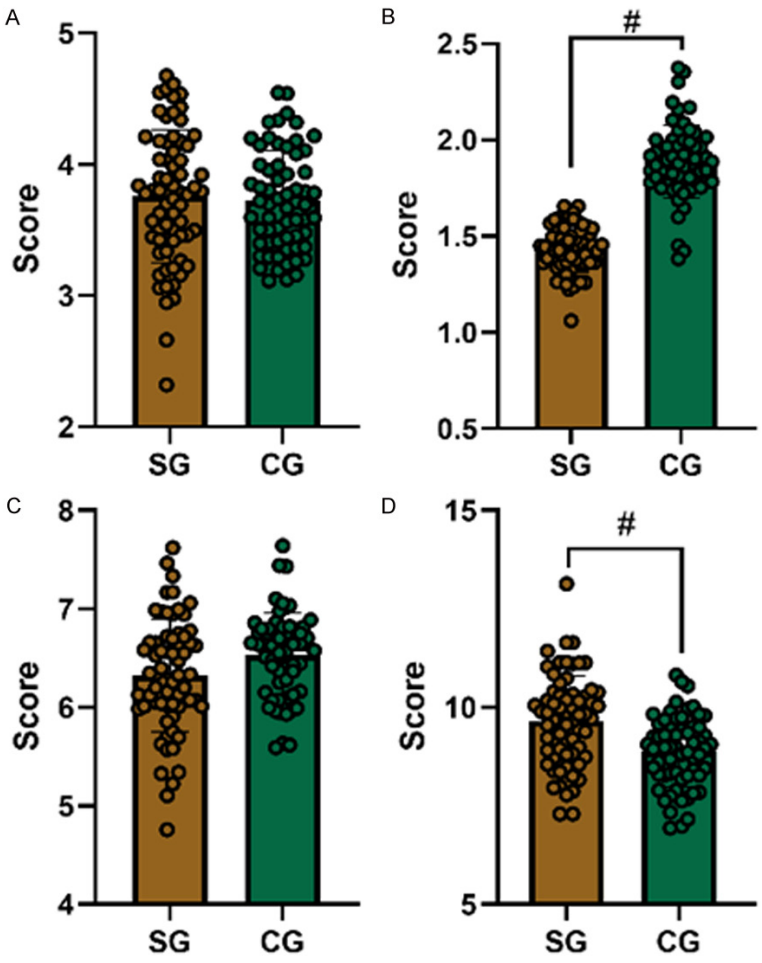

Figure 1. Comparison of swallowing function. The differences between the two groups before nursing were not statistically significant ($P > 0.05$) for the Kubota drinking test (A) and the IFRS score (C). After nursing, the patients in the study group had a lower Kubota drinking test score (B) and a higher IFRS score (D) than the control group ($P < 0.05$). $^{\#}P < 0.05$ compared with the control group. IFRS: Ichiro Fujishima Rating Scale; SG: Study Group; CG: Control Group.

group were significantly lower than those in the control group at 24 h, 48 h and 72 h postoperatively ($P < 0.05$) (**Figure 3**).

Comparison of the incidence of complications

The incidence of adverse reactions was 8.96% in the study group, which was significantly lower than 28.57% in the control group, exhibiting a statistical difference ($P < 0.05$) (**Table 4**).

Analysis of influencing factors for postoperative recovery

Logistic regression analysis showed that age was an important negative factor for accelerating postoperative recovery of patients with thyroid cancer ($P < 0.05$). The length of hospitalization increased significantly with age, and age of patients was positively correlated with length of hospital stay ($r = 0.3957$, $P < 0.0001$) (**Table 5**; **Figure 4**).

Discussion

Thyroid cancer accounts for about 1% of all malignant tumors, and can be specifically divided into four pathological types: papillary, follicular, undifferentiated, and medullary carcinomas, among which papillary carcinoma is the most common type, with low malignant degree and good prognosis [15, 16]. The incidence of thyroid cancer is related to region, race, and gender, and the incidence is slightly higher in women than that in men, with a male to female ratio of about 1:2 [17].

Surgery remains the most effective treatment option for thyroid cancer, and removal of the lesion can effectively prolong patients' survival and improve their quality of life [18]. It has been pointed out that surgery is one of the stressors that brings unavoidable damage to patients, induces anxiety and depression, affects sleep quality and quality of life of patients, and some patients may also develop serious complications such as hoarseness and swallowing disorders, thus, perioperative intervention for patients with thyroid cancer has been one of the key directions of nursing research [19]. In this study, the FTS model significantly improved the postoperative swallowing function of patients with thyroid cancer compared with the traditional model, which was similar to the results of a previous study [20]. In a controlled analysis conducted on 80 thyroid cancer patients, the results showed that FTS could significantly shorten the length

Table 3. Comparison of perioperative rehabilitation indicators ($\bar{x} \pm s$)

Group	Number of cases	Time to drainage tube removal (d)	Time to anal exhaust time (d)	Time to first getting out of bed activities (d)	Length of hospitalization (d)	Medical costs (yuan)
Study group	67	3.75±1.68	1.68±0.23	2.53±1.79	6.83±1.02	20630.4±1726.62
Control group	63	5.27±2.34	2.07±0.54	4.26±2.06	8.75±1.17	22890.5±2173.62
t	-	4.274	5.413	5.120	6.382	4.183
P	-	< 0.001	< 0.001	< 0.001	0.000	0.002

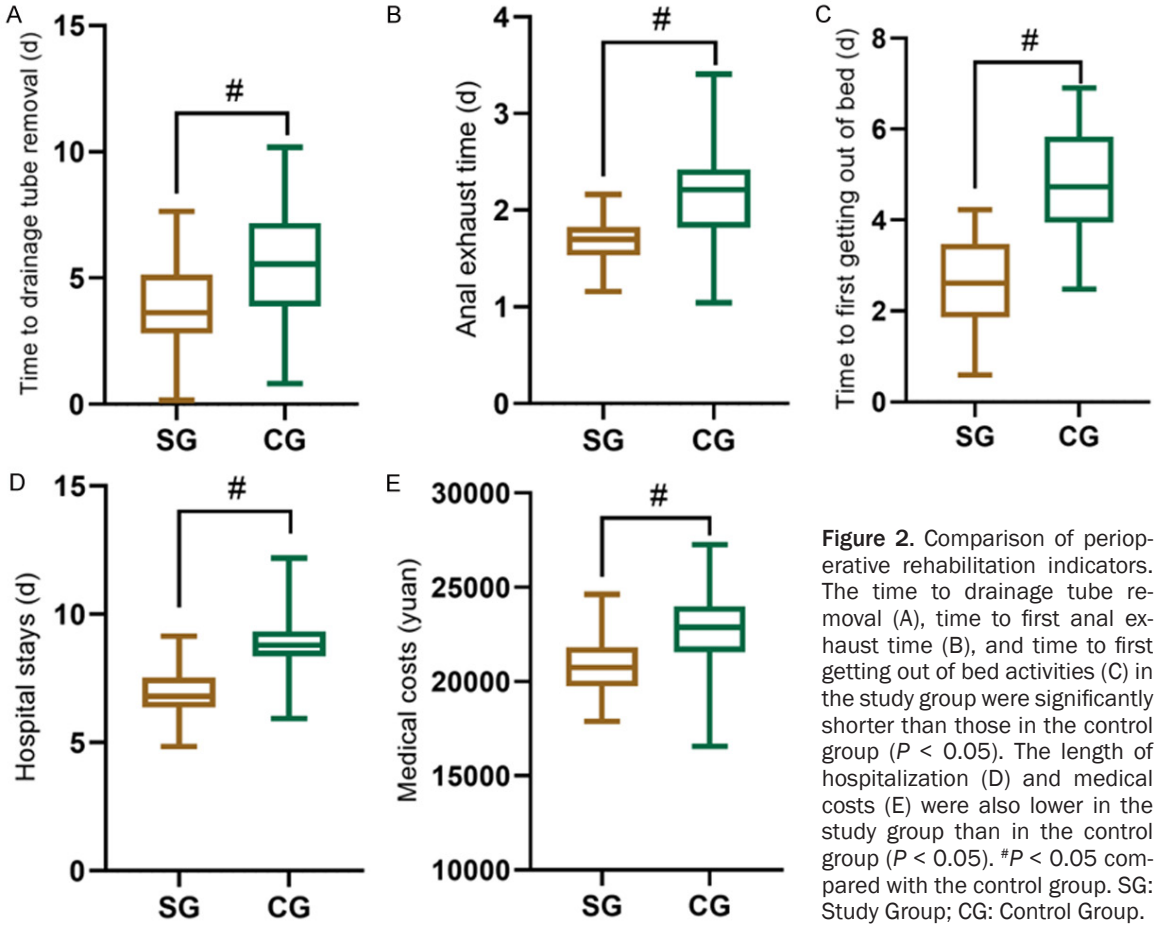

Figure 2. Comparison of perioperative rehabilitation indicators. The time to drainage tube removal (A), time to first anal exhaust time (B), and time to first getting out of bed activities (C) in the study group were significantly shorter than those in the control group ($P < 0.05$). The length of hospitalization (D) and medical costs (E) were also lower in the study group than in the control group ($P < 0.05$). $^{\#}P < 0.05$ compared with the control group. SG: Study Group; CG: Control Group.

of hospital stay of patients and reduce the incidence of swallowing disorders in patients, which has positive significance for improving the prognosis of thyroid cancer patients [21]. Another analysis of patients with thyroid cancer indicated that FTS intervention in such patients could help accelerate postoperative rehabilitation, significantly reduce the impact of surgery on the organ function of patients, and reduce the incidence of postoperative complications [22]. In this study, the authors believe that perioperative optimization measures based on evidence-based medicine can alleviate the stress response under FTS, thus accelerating postoperative healing of patients, which is more targeted and directional than traditional nursing. On the one hand, it can significantly improve the direction of nursing, and on the other hand, it can help optimize the allocation of medical resources. This is also evidenced by the superiority of the perioperative rehabilitation indicators of the study group over the control group. In the study, the time to drainage tube removal, time to first anal exhaust, and time to first getting out of bed activities in the study group were significantly shorter than those in the con-

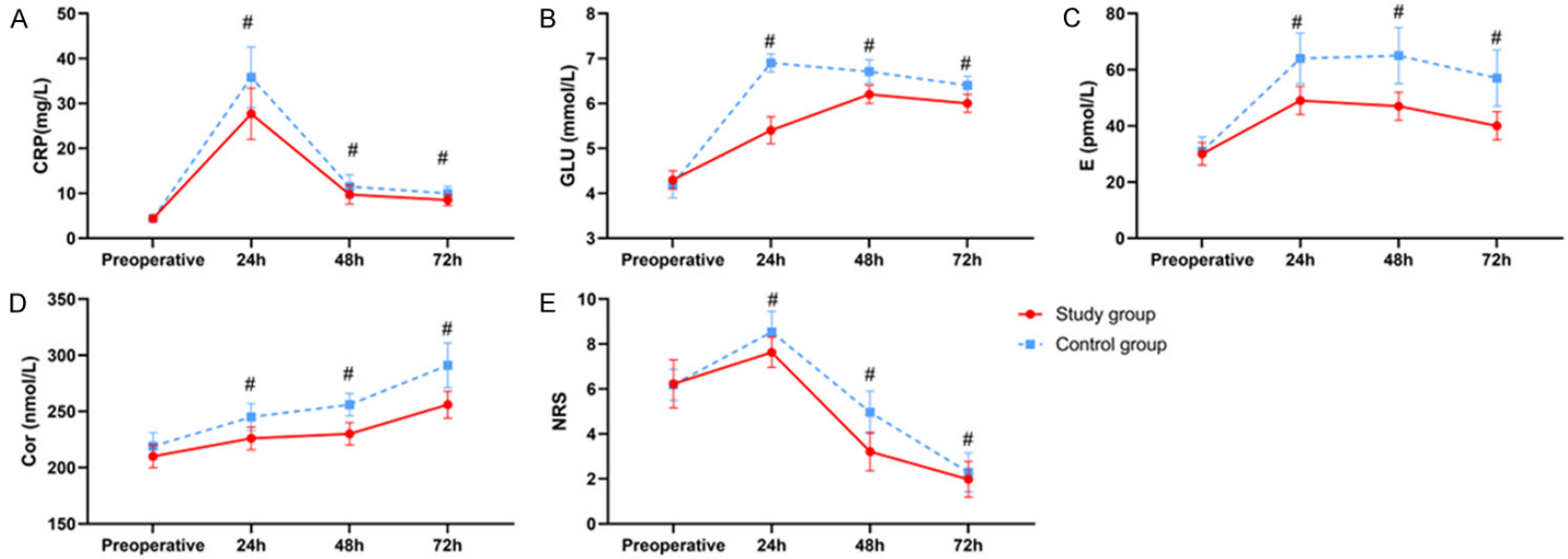

Figure 3. Comparison of perioperative stress indicators. Postoperative CRP (A), GLU (B), E (C), and Cor (D) levels increased in both groups, but the level of increase in the study group was significantly lower than that in the control group ($P < 0.05$). The NRS scores in the study group were significantly lower than those in the control group at 24 h, 48 h and 72 h after surgery ($P < 0.05$) (E). $^{\#}P < 0.05$ compared with the control group. CRP: C-reactive Protein; GLU: Glucose; E: Epinephrine; Cor: Cortisol; NRS: Numerical Rating Scale.

Table 4. Comparison of incidence of complications [n (%)]

Group	Number of cases	Incisional infection	Skin scarring	Hoarseness	Rostral nerve injury	Hypocalcemic convulsions	Total incidence
Study group	67	1 (1.49%)	1 (1.49%)	3 (4.48%)	1 (1.49%)	0 (0.00%)	6 (8.96%)
Control group	63	3 (4.76%)	2 (3.17%)	8 (12.70%)	2 (3.17%)	3 (4.76%)	18 (28.57%)
χ^2	-	-	-	-	-	-	8.300
P	-	-	-	-	-	-	0.004

Table 5. Multivariate logistic regression analysis of accelerating postoperative recovery

Variable	Partial regression coefficient	SE	Wald	P	95% CI
Age	-0.156	0.068	7.512	0.005	0.745-0.985

SE: Standard Error; 95% CI: 95% Confidence Interval.

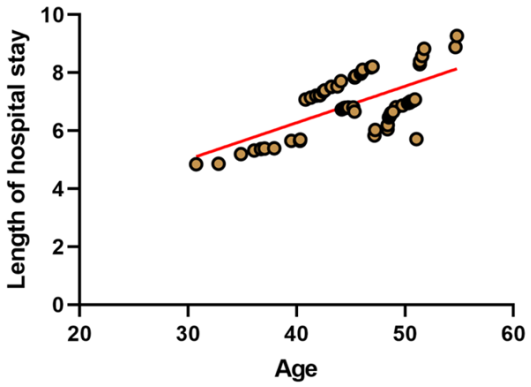

Figure 4. Correlation analysis of age and length of hospital stay. There was a significant positive correlation between the age of patients and the length of hospital stay (r = 0.3957, P < 0.0001).

trol group, and the length of hospitalization and medical costs were also lower than those in the control group, which further confirmed the advantages of FTS in promoting patients' rehabilitation and shortening length of hospitalization.

The results of this study further demonstrated the basis for the efficacy of FTS by comparing the perioperative stress indicators between the two groups of patients, suggesting that the postoperative CRP, GLU, E, and Cor levels were lower in the study group than in the control group, and the NRS scores were also lower than those in the control group. C-reactive protein is an acute protein synthesized by the liver after inflammatory stimulation such as microbial invasion or tissue injury, and it increases rapidly in the presence of acute inflammation and tissue injury. It is one of the indicators that is very sensitive to infection and injury [23, 24]. The preoperative serum CRP concentration in both groups was lower than 12 mg/L, suggesting that no inflammatory injury occurred before surgery, and the postoperative CRP levels increased in both groups compared with the preoperative level, and the elevated level in the study group was significantly lower than that in the control group (P < 0.05), demonstrating that FTS reduced the stress response of patients, attenuated the occurrence of inflammatory reactions, and improved the safety of surgery through perioperative management of patients. Patients are mostly accompanied by pain after surgery, and excessive pain can cause endocrine and gastrointestinal dysfunction, thus delaying the recovery of all organs after surgery, so timely and effective pain management for patients is needed [25]. Adequate pain relief is an important part of FTS, and patients were educated about postoperative pain management to correct their misconceptions about pain and improve their pain threshold. Multimodal analgesia and timely drug administration can quickly and effectively relieve the postoperative pain and reduce the impact of pain on patients [26]. The postoperative NRS scores of patients in the study group were significantly lower than those in the control group at 12 h, 24 h, 48 h, and 72 h. This showed that the postoperative pain level of patients with thyroid cancer was significantly reduced after postoperative nursing with FTS, which was consistent with previous findings. The comparison of the complications also confirmed the safety and effectiveness of FTS. Finally, in order to analyze the indicators influencing the rapid recovery process of thyroid cancer patients, age, course of disease, and other indicators of patients were included in this study, and the multivariate Logistic regression analysis was conduct-

ed. The results showed that age was an important negative factor for postoperative recovery of patients with thyroid cancer. Further, Pearson correlation analysis found that there was a positive correlation between the age of the patients and their length of hospital stay, which was consistent with the research results of other scholars. A study of 90 patients with thyroid cancer found that the length of hospital stay in patients aged > 75 years old was significantly higher than that in patients aged < 60 years old, even though the elderly patients in both groups received the same perioperative intervention [27]. The reason may likely attributed to the fact that with the increase of age, the patient's physical recovery ability decreases further, with a higher probability of complications induced by surgical trauma on the one hand and a longer recovery time for the patient after surgery on the other hand.

In conclusion, perioperative FTS nursing in thyroid cancer patients can improve postoperative swallowing function, shorten the recovery time of patients and reduce the incidence of complications, which may be related to the improvement of the perioperative stress response of patients with FTS. The limitations of this study are that the source of included patients is relatively simple, and the sample size is small, which may affect the accuracy of the results to a certain extent. In view of the above deficiencies, a large-sample, multi-center prospective study is proposed to be conducted at a later stage to provide a more solid theoretical basis for the conclusions by including patients with various disease types from multiple medical institutions.

Disclosure of conflict of interest

None.

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