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Original Article

Application effects of quality control circle management for patients with gastrointestinal tumor surgeries during the perioperative period

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Abstract: Objective: The aim of this study was to investigate the application effects of quality control circle (QCC) management for patients with gastrointestinal tumor surgeries during the perioperative period. Methods: A total of 60 patients having undergone selective operations, in Ruian People's Hospital, from June 2017 to December 2017, were taken as the observation group. They were nursed with quality control circle management. A total of 50 patients, treated from January 2017 to June 2017, were selected as the control group and treated with routine nursing. Operation times, intraoperative blood loss, first exsufflation times, first defecation times, and first off-bed activity times of patients in the two groups were recorded and analyzed. In addition, anxiety states of patients in the two groups on admission, 1 day before surgery, and 3 days after surgery, as well as pain scores at 2 hours, 12 hours, 24 hours, 48 hours, and 72 hours after surgery, were recorded. Satisfaction, complications, and invisible achievement scores, before and after QCC, were also recorded. Results: There were no differences in operation times and intraoperative blood loss between the two groups (both P>0.05). The observation group showed an earlier time in the first drinking, first exsufflation, first defecation, and first off-bed activity than the control group. Differences were statistically significant (all P<0.05). The observation group showed lower scores in state anxiety (SAI) and trait anxiety (TAI) 1 day before surgery and 3 days after surgery than the control group. Differences were statistically significant (all P<0.05). The observation group showed significantly lower scores in numeric rating scale (NRS) and visual analogue scale (VAS) at 2, 12, and 24 hours after surgery than the control group. Differences were statistically significant (all P<0.05). However, there were no differences in VAS scores at 48 and 72 hours after surgery (both P>0.05) and no differences in NRS scores at 72 hours after surgery between the two groups (P>0.05). The observation group showed higher satisfaction and significantly lower incidence of complications than the control group (both P<0.05). The invisible achievement score of the nursing staff participating in the study at the end of quality control circle was significantly higher than the initial score (P<0.05). Conclusion: Quality control circle initially improved preoperative, intraoperative, and postoperative procedures for the nursing staff, effectively lowering occurrence of adverse outcomes due to a lack of specialist knowledge and untimely and incomplete observation of the disease.

Keywords: Quality control circle, general surgery, nursing during perioperative period, anxiety, pain

Introduction

With the rapid development of society and changes in the medical model and patient knowledge structure and values, higher and higher requirements have been implemented for nursing quality. This presents a new challenge for the nursing industry [1-3]. Quality control circle (QCC) refers to a small group, spontaneously formed by people in the same workplace, with simple statistical methods of quality control. They work to solve work problems and improve work efficiency, which can give full play to each person's creativity and experience, improving quality [4, 5]. Although China began to introduce QCC into the medical service industry in 2001, research projects in nursing QCC in China have increased and gradually matured [6]. Domestic scholars have applied QCC to ICU sputum aspiration in artificial airways, achieving good clinical results in General Wards and Geriatric Wards of Psychiatry [7, 8]. General surgery is the most common and widely applied routine surgical treatment. Nursing quality during the perioperative period is directly related to the success rates of sur-

gery and safety of patients [9]. For some patients, general surgery only prolongs long-term survival rates and poor prognosis, caused by postoperative pain and complications, directly affects recovery [10]. This study aimed to apply QCC to patients undergoing general surgery during the perioperative period, aiming to investigate the effects for better clinical service.

Materials and methods

General data

A total of 60 patients having undergone selective operations, in Ruian People's Hospital, from June 2017 to December 2017, were taken as the observation group. They were nursed with quality control circle management. A total of 50 patients, treated from January 2017 to June 2017, were selected as the control group and treated with routine nursing. This study was approved by the Ethics Committee of Ruian People's Hospital. All patients and families provided informed consent.

Inclusion criteria: (1) Patients confirmed with gastrointestinal tumors in clinical pathological examinations and treated with surgical excision; (2) Patients at 18.0-60.0 years old; (3) Patients with junior diploma and above that were able to read and understand the scoring methods in this study; (4) Patients with tumor differentiation grades lower than G3 and TNM staging less than three phases.

Exclusion criteria: (1) Patients with blood coagulation dysfunction, abnormal immune systems, and endocrine diseases: (2) Patients with mental disorders or unconsciousness; (3) Patients having undergone emergency surgery; (4) Patients with late recurrence that underwent palliative resections; (5) Patients with severe system insufficiencies of the heart, liver, kidneys, blood, digestion, and nerves; (6) Patients having undergone abdominal and thoracic surgery; (7) Patients complicated with hypertension, diabetes mellitus, and cardiovascular disease.

Data concerning present researchers

Ruian People's Hospital boasts of 11 nurses at 22.0-48.0 years old (mean age of (33.5±8.5) years old), with professional qualifications and 2-15 years of working experience (average working experience of (5.9±3.8) years). These include 1 co-chief superintendent nurse, 3 responsible supervisor nurses, 3 senior nurses, and 4 normal nurses.

Methods

The control group was treated with routine nursing. They were brought together in a group lecture about surgery, upon admission, to acquaint them with the purpose of the surgery, cooperation points during the surgery, as well as postoperative pain and precautions in the placement of catheters, drainage tubes, and additional instruments. The observation group was treated with nursing quality management with quality control circle based on routine nursing. Specific steps and methods were: (1) A quality control circle was established with senior nurses in a ward. A head of the department was democratically selected as the quality control circle leader and a head nurse was the instructor. The circle was named "hand-to-hand circle", aiming to make nurses work together with the patients to improve the effects of general surgery on patients during the perioperative period; (2) A forum was organized once a week to determine the theme of an activity. During the activity meeting, each circle member proposed a candidate topic for discussion in the meeting. The theme at this time was determined to be a theme of improving the nursing quality on patients with general surgery during the perioperative period and prognosis of patients; (3) The reasons were analyzed. Circle members were brought together to analyze the status of ward nursing on patients with general surgery. They studied and discussed the reasons from personnel (patients, nurses, doctors) and the environment in the form of brainstorming, aiming to find the true reasons based on on-site inspections; (4) Countermeasures: The patients were given health education and acquainted with the nursing plan for surgery during the perioperative period in detail 1 day before the surgery. This was to dispel any doubts, tension, and anxiety, which helped to enhance their confidence in overcoming the disease. Preoperative preparations, including skin preparation and blood collection, was improved. The patients were banned from eating within 6 hours before surgery and drinking within 2 hours before surgery to keep them in a more appropriate anabolic state. During surgery, necessary insulation measures were taken by maintaining the air-conditioning temperature at 25-28°C, cover-

ing quilts for patients, and warming washing saline in advance for intraoperative washing. These measures helped to maintain normal temperatures. After surgery, patients were assessed by a numeric rating scale (NRS) for pain and treated with fentanyl citrate injections (China Yichang Humanwell Pharmaceutical Co., Ltd.) of 0.001 mg/kg through intravenous patient-controlled analgesia (China Xinwei Medical Equipment) for analgesia management. Changes in disease were observed in real time and were communicated with relevant personnel actively.

Outcome measures

Data collection: Relevant information concerning the patients was collected based on patient admission diagnosis and medical history investigations, including gender, age, body mass index (BMI), and disease type.

Main indexes: Operation times, intraoperative blood loss, first exsufflation times, first defecation times, and first off-bed activity times of the patients in the two groups were recorded and analyzed. State-trait anxiety inventory (STAI) with 40 questions was adopted, of which the first 20 questions were the total score in SAI. The last 20 were the total score in TAI. The minimum and maximum total scores of the inventory were 20 and 80, respectively. Higher scores indicate higher anxiety levels [11]. SAI and TAI scores of the patients, on admission, 1 day before surgery, and 3 days after surgery, were recorded. Also, NRS was adopted. The NRS consisted of 11 numbers from 0-10. Larger numbers indicate greater pain: 0: no pain; 1-3: mild pain; 4-6: moderate pain; 7-9 severe pain; 10: sharp pain [12]. Visual analog scale (VAS): A 10 cm horizontal line was drawn on a paper with one end of 0 indicating no pain and another end of 10 indicating sharp pain [13]. Scores of NRS and VAS of patients on admission, 2 hours after surgery, or 12, 24, 48, and 72 hours after anesthesia recovery were recorded.

Secondary indexes: Self-assessed invisible achievement scores, before and after quality control circle, were recorded [14]. The self-assessed table for invisible achievement scores consists of 1-10. Larger numbers indicate higher mastery: 1-2: very bad; 3-4: not good; 5-6: normal; 7-8: good; 9-10: very good. Patient satisfaction was obtained by questionnaire surveys, which were divided into satisfaction and dissatisfaction. One day before discharge, all questionnaires were collected. Complications of the patients included incision infections: patients showed aggravated pain in the incision 3-4 days after surgery, risen body temperatures, speeded pulse rates, and increased number of white blood cells [15]. Disruption of abdominal incision: this appeared in patients with a large amount of pink bloody fluid suddenly flowing out from the abdominal incision, as well as internal cavity exposure in the disrupted incision with intestines, omentum, and so forth [16]. Intestinal adhesion: patients showed abdominal discomfort and dull pain, repeated vomiting, prolonged defecation, exsufflation, and abdominal distension within 1-2 weeks after surgery [17].

Statistical methods

SPSS version 21.0 was adopted for statistical analysis. Measurement data are expressed as mean ± standard deviation ($\overline{x}$ ± sd). Measurement data of the two groups in normal distribution were processed with t-test. Data not in normal distribution were processed with rank sum test. Enumeration data are expressed as number/percentage (n/%) and were processed with χ^2 test or Fisher's exact probability method.

Results

Comparison of general materials

There were no differences in gender ratio, age, BMI, and proportion of patients with tumors in each stage between the two groups (all P>0.05), see **Table 1**.

Comparison of surgical conditions

There were no differences in operation times and intraoperative blood loss between the two groups (both P>0.05). See **Table 2**, **Figure 1A** and **1B**. The observation group showed earlier times in the first drinking, first exsufflation, first defecation and first off-bed activity than the control group. Differences were statistically significant (all P<0.05). See **Figure 1C-F**.

Comparison of anxiety indexes

There were no differences in SAI and TAI scores between the two groups on admission (both P>0.05). The observation group showed lower scores in SAI and TAI 1 day before surgery and 3 days after surgery, compared to the control

Table 1. General materials ($\bar{x}$ ± sd)

Group	Control group (n=50)	Observation group (n=60)	t/χ^2	P
Gender	26/24	33/27	0.099	0.753
Age (years old)	54.0±11.1	52.7±10.3	0.611	0.543
BMI (kg/m^2)	22.79±3.84	23.56±4.95	0.894	0.373
Tumor stage			0.487	0.784
Stage 1	18 (36.00)	20 (33.33)		
Stage 2	16 (32.00)	23 (38.33)		
Stage 3	16 (32.00)	17 (28.33)		

Note: BMI, body mass index.

Table 2. Comparison of surgical conditions ($\bar{x}$ ± sd)

Group	Control group (n=50)	Observation group (n=60)	t	P
Operation time (min)	305.47±90.98	292.16±80.76	0.807	0.422
Intraoperative blood loss (mL)	312.47±90.98	287.54±71.64	1.573	0.119
First drinking time (d)	2.48±0.91	1.15±0.82	8.062	<0.0001
First exsufflation time (d)	3.28±1.15	1.19±0.85	10.457	<0.0001
First defecation time (d)	6.54±1.01	4.50±0.91	11.198	<0.0001
First off-bed activity time (d)	4.36±0.68	3.85±0.73	3.763	0.0003

group. Differences were statistically significant (all P<0.05). See **Table 3**, **Figure 2A**, **2B**.

Comparison of pain

The observation group showed significant lower scores in NRS and VAS at 2 hours, 12 hours, and 24 hours after surgery than the control group. Differences were statistically significant (all P<0.0001). In addition, the observation group showed lower NRS than the control group at 48 hours after surgery (P<0.05), but no differences in NRS scores at 72 hours after surgery (P>0.05). There were no differences in VAS scores at 48 hours and 72 hours after surgery (both P>0.05). See **Tables 4**, **5** and **Figure 3A-B** for details.

Comparison of patient satisfaction and complications

The observation group showed significantly higher satisfaction and significant lower incidence of complications than the control group. Differences were statistically significant (both P<0.05). See **Table 6**.

Comparison of invisible achievement before and after QCC

Before the start of the quality control circle, the nursing staff involved in this study showed significant higher scores in professional knowledge, sense of responsibility and honor, self-confidence, team cohesion, communication, cooperation, and sense of joviality after improvement. Differences were statistically significant (all P< 0.05). See **Table 7** and **Figure 4**.

Discussion

There are many patients in the Department of General Surgery with complicated symptoms. At present, pain is mainly alleviated by surgery. Because surgery on patients with gastrointestinal tumors features resections of a large amount of cancer tissues, large trauma, hemorrhages, and long operation times, patients often show high incidence of postoperative complications, poor prognosis, and long hospitalizations. Therefore, it is urgent to improve the levels of medical equipment and quality and nursing skills. Good nursing during the perioperative period can reduce or avoid physiological and psychological traumatic stress responses of patients, achieving maximum recovery [18, 19]. Many studies have reported that nursing quality on patients with general surgery during the perioperative period has a certain impact on surgical outcomes and postoperative complications [20, 21]. Studies have reported that QCC in the operating room and ICU has greatly improved the quality of infection control and overall efficacy of the hospital, indirectly reducing medical costs [22]. The activity of "Demonstration Project of High-Quality Nursing Service" was an important part of the reform of public hospitals. Quality control circle activities play an important role in improving the doctor-nurse relationship, as well as patient satisfaction. Quality control circle has achieved significant clinical results in clinical transfusion centers, pediatric wards, nursing teaching, and night ward inspections by nurses [23, 24].

A quality control circle emphasizes the effective combination of the internal staff in a working

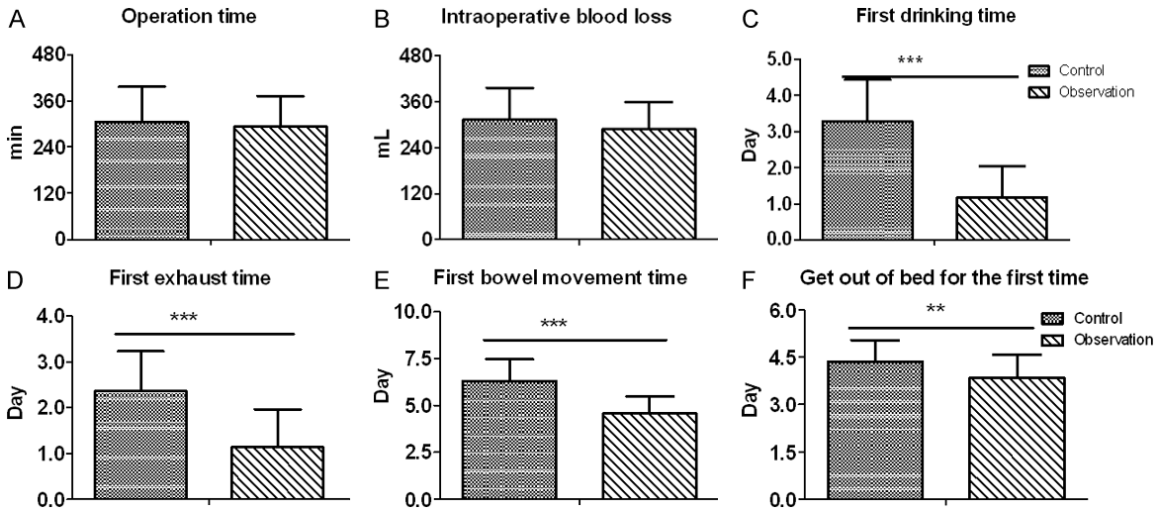

Figure 1. Comparison of surgical conditions. A. Operation time; B. Intraoperative blood loss; C. The first drinking time after surgery; D. The first defecation time after surgery; E. The first exsufflation time after surgery; F. The first off-bed activity time after surgery. The earlier the above times were, the better the effects of postoperative rehabilitation were. **P<0.001, ***P<0.0001.

Table 3. Comparison of anxiety indexes ($\bar{x}$ ± sd)

Group	Control group (n=50)	Observation group (n=60)	t	P
SAI				
On admission	40.42±5.19	39.44±5.44	1.001	0.319
1 day before surgery	42.00±4.12	36.82±5.81	5.483	<0.0001
3 days before surgery	41.63±5.35	32.41±4.39	10.195	<0.0001
TAI				
On admission	37.65±6.46	37.57±8.13	0.073	0.942
1 day before surgery	42.15±5.17	35.52±6.39	6.113	<0.0001
3 days before surgery	43.09±6.38	31.44±7.25	9.136	<0.0001

Note: SAI, state anxiety inventory; TAI, trait anxiety inventory.

group, forming a community to discover, discuss, and solve problems in work, thereby improving work efficiency and teamwork ability. These factors improve the economic benefits and staff quality. In addition, in a quality control circle, the working atmosphere is more harmonious. Therefore, the purpose of improving patient prognosis and increasing satisfaction is achieved with quality control circles. Results of this study showed no differences in operation times and intraoperative blood loss between the two groups, while the observation group showed earlier times in the first drinking, first exsufflation, first defecation, and first off-bed activity than the control group. Differences were statistically significant. The observation group showed lower scores in SAI and TAI 1 day before surgery and 3 days after surgery than the control group. Differences were statistically significant. This was mainly due to the nursing staff in the quality control circle paying more attention to changes in the patient's physical performance and psychological states, scientifically and effectively counseling patients, dispelling psychological disorders and anxiety.

The main cause of postoperative pain in patients with general surgery is trauma caused by surgery, a response process of a series of pain sensation and pain perception [25]. A significant psychological stress response caused by surgical pain is anxiety. There is a close relationship between the two. Intervention in anxiety during the perioperative period can reduce postoperative pain. Pain relief can effectively control anxiety symptoms, complementing each other [26]. Patients in the observation group were aware of possible problems during the perioperative period and were able to use the analgesia pump reasonably. The nursing staff can effectively help patients divert attention from pain and establish confidence of recovery. Therefore, the observation group showed significant lower scores in NRS and VAS at 2, 12, and 24 hours after surgery than the control group. Differences were statistically

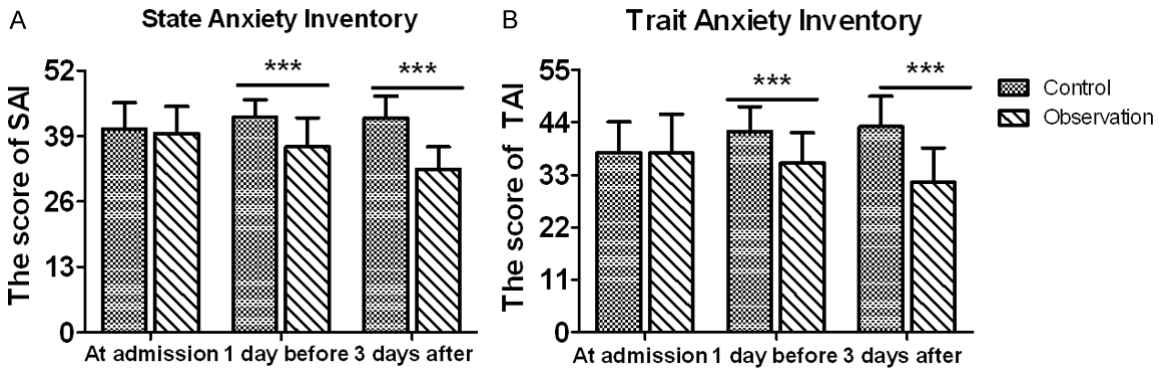

Figure 2. Comparison of anxiety indexes. A. Total state anxiety inventory; B. Total trait anxiety inventory. The higher the above scores were, the more severe patient anxiety states were. ***P<0.0001.

Table 4. Comparison of NRS ($\bar{x}$ ± sd)

Group	Control group (n=50)	Observation group (n=60)	t	P
2 h	3.58±0.92	2.12±0.33	11.316	<0.0001
12 h	3.19±1.01	2.01±0.41	8.257	<0.0001
24 h	2.58±0.77	1.73±0.56	6.638	<0.0001
48 h	1.64±0.55	1.42±0.51	2.198	0.030
72 h	1.44±0.48	1.37±0.51	0.750	0.455

Note: NRS, numeric rating scale.

Table 5. Comparison of VAS ($\bar{x}$ ± sd)

Group	Control group (n=50)	Observation group (n=60)	t	P
2 h	6.26±1.20	4.99±0.94	6.080	<0.0001
12 h	5.59±1.03	3.20±0.85	13.073	<0.0001
24 h	5.08±0.93	2.50±0.57	16.935	<0.0001
48 h	2.00±0.59	1.89±0.47	1.115	0.267
72 h	1.85±0.36	1.78±0.29	1.074	0.285

Note: VAS, visual analogue scale.

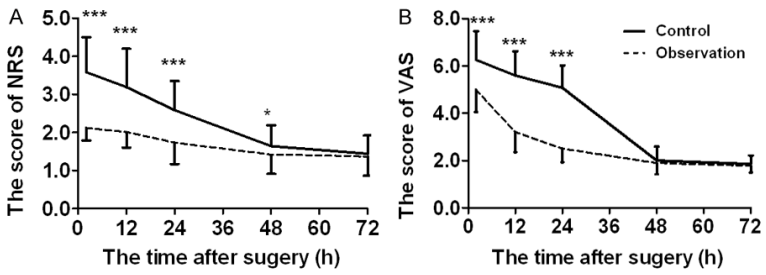

Figure 3. Comparison of pain. A. NRS scores at 2, 12, 24, 48, and 72 hours at resting after surgery; B. VAS scores at 2, 12, 24, 48, and 72 hours at resting after surgery. The higher the score was, the higher the pain index was. NRS, numeric rating score; VAS, visual analogue score. *P<0.05, ***P<0.0001.

significant. The acute pain period, within 24 hours after surgery, is a critical period for patients. They should receive postoperative early mobilization, functional exercises, and nutritional support, which are essential for the recovery of various system functions of patients after surgery and the establishment of confidence to overcome the disease. Comparison of invisible achievements between the two groups indicated that the observation group showed higher scores in professional knowledge, sense of responsibility and honor, self-confidence, team cohesion, communication with patients, and sense of joviality than the control group. In this quality control circle, the circle members had meetings regularly. Each member was involved actively in searching data and references, pooling ideas, and cooperating with each other, in aspects such as causes analysis and measure finding in a good working atmosphere. The observation group also showed higher satisfaction and lower incidence of complications than the control group. Differences were statistically significant. The above results also suggest that quality control circle management can improve patient satisfaction, reduce contradictions between doctors and patients, reduce

Table 6. Comparison of patient satisfaction and complications (n, %)

Group	Control group (n=50)	Observation group (n=60)	t/χ^2	P
Degree of satisfaction			5.123	0.024
Dissatisfaction	12 (24.00)	5 (8.33)		
Satisfaction	38 (76.00)	55 (91.67)		
Complication				
Incision infection	2 (4.00)	1 (16.67)		
Disruption of abdominal incision	3 (6.00)	0		
Intestinal adhesion	3 (6.00)	1 (16.67)		
Total	8 (16.00)	2 (33.33)	3.873	0.049

Table 7. Comparison of invisible achievement before and after QCC ($\bar{x} \pm sd$)

Group	Control group (n=50)	Observation group (n=60)	t	P
Professional knowledge	4.72±0.78	7.63±0.92	7.950	<0.0001
Sense of responsibility and honor	4.82±0.75	9.36±0.50	16.670	<0.0001
Self-confidence	5.09±0.83	8.55±0.69	10.621	<0.0001
Team cohesion	5.18±0.87	8.73±1.01	8.809	<0.0001
Communication	4.73±0.91	8.09±1.04	8.074	<0.0001
Cooperation	4.91±1.04	9.18±0.75	11.021	<0.0001
Sense of joviality	4.72±0.78	7.63±0.92	7.950	<0.0001

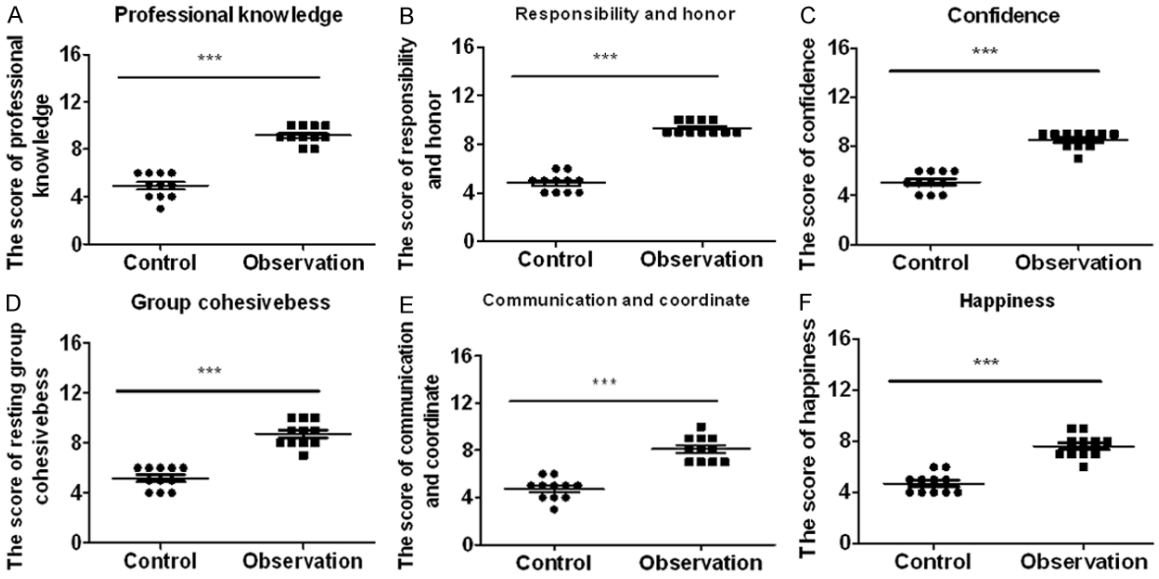

Figure 4. Comparison of invisible achievement before and after QCC. A. Professional knowledge score; B. Score of sense of responsibility and honor; C. Self-confidence score; D. Team cohesion score; E. Communication and cooperation score; F. Score of sense of joviality. The higher the scores were, the better the invisible achievement of QCC on the nursing staff was. QCC, quality control circle. ***P<0.0001.

postoperative complications, and promote patient recovery.

However, the number of patients involved in this study was relatively small. Inconsistencies of patient compliance may have affected the accuracy of results. The inconsistent disease type and severity of patients may have led to some differences in postoperative recovery. Therefore, the results of this study should be

further improved and confirmed. In addition, in the study, it was found that anxiety of patients, before surgery, and postoperative pain were closely related to the patients' inability to correctly understand their own symptoms and surgical procedures. The next task was to popularize knowledge about general surgery diseases through WeChat, publicity columns, and mobile APP. These help people to fully understand the diagnosis and treatment risk and treatment methods of the diseases, reducing patient anxiety. In addition, another focus was to improve the collaboration of doctors, nurses, and anesthetists in departments such as the Anesthesiology Department and Operating Rooms, taking full advantage of each department. Patients during the perioperative period can enjoy nursing of the highest quality, which should be more scientific and reasonable.

The quality control circle initially improves preoperative, intraoperative, and postoperative procedures of the nursing staff and effectively lowers occurrence of adverse outcomes due to lack of specialist knowledge along with untimely and incomplete observation of disease. During the activity, communication among doctors, nurses, and patients was strengthened, effectively improving the patient's sense of safety and cooperation and reducing postoperative complications. This method helps to achieve the goal of improving the overall quality of medical nursing and patient satisfaction.

Disclosure of conflict of interest

None.

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