Original Article
Effect of quality control circle on nursing in orthopaedic trauma surgery

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Abstract: Objective: To explore the application effect of Quality Management Circle (QCC) in nursing of orthopaedic trauma surgery. Methods: The clinical data of 134 cases undergoing orthopaedic trauma surgery were assigned into 2 groups according to different nursing methods. Thereinto, 67 cases with traditional nursing were considered as the control group (CG), and the left with traditional nursing and QCC activities were assigned as the study group (SG). The pain (VAS) score and psychological fluctuation index were observed and compared at various time points after operation. The recorded indexes included anxiety (SAS) and depression (SDS) scores before and after intervention, limb joint activity, health knowledge awareness rate, satisfaction rate, quantitative score of quality of life and nosocomial infection rate. Results: After intervention, the VAS scores in the SG were lower than those in the CG 2 weeks after intervention (all P<0.05). The quantitative scores of SDS and SAS in the SG after intervention were lower than those in the CG (all P<0.05). After that, the range of motion of lower limb joints in the SG was higher than that in the CG (all P<0.05). The awareness rate of health knowledge in the SG was higher than that in the CG (all P<0.05). The satisfaction rate of the SG was higher than that of the CG (P<0.05). The score level of each index of quality of life in the SG was higher than that in the CG (all P<0.05). There was no marked difference in nosocomial infection rate (P>0.05). Conclusion: The application of QCC on patients undergoing orthopaedic trauma surgery can not only reduce patients' pain, negative emotions, but also improve limb joint activity, health knowledge awareness rate, satisfaction rate and quality of life.

Keywords: Quality control circle, orthopaedic trauma surgery, nursing, nosocomial infection, satisfaction rate

Introduction

Quality control circle (QCC) refers to the effective quality control and active activities of the business strategy, policy and the problems existing in various jobs, aiming to reduce labor costs, as well as to improve work quality and efficiency [1]. The main feature of QCC is to continuously improve the quality for a series of problems existing in themselves [2]. Recently, with the rapid development of China's economic conditions and the continuous advancement of medical service reform, the standard of clinical medical services need to be improved urgently [3]. Orthopaedics is a vital department with very complex and diverse diseases, espe-cially the patients with traumatic orthopedics, whose condition is more complex [4, 5]. Patients with orthopaedic trauma takes longer time to recover, and different treatment methods are taken for patients with different requirements. At the same time, due to the actual needs of different patients for diagnosis and care, various conflicts and contradictions frequently occur between trauma orthopedic patients and medical staff [6]. Therefore, it is quite essential to effectively improve the nursing quality of traumatic orthopedic surgery through a series of relevant measurements [7]. It has been pointed out that with QCC, the medical quality of hospitals and clinical satisfaction of patients have been practically improved.

The trauma of orthopedic patients is often caused by sudden natural and man-made disasters or accidents in daily life, which is quite different from the manifestations of ordinary hospitalized patients. It is therefore not uncommon for patients to have strong emotional reaction to a sudden trauma. Meanwhile, orthopedic trauma patients have varying degrees of body and limb fractures, severe pain, long braking time and bed rest time, slow recovery, physical and psychological trauma and even torture to patients. The current routine nursing, which pays more attention to the nursing of trauma sites instead of the psychological state of patients, makes patients prone to impatience in the process of rehabilitation. In view of the differences of different treatment stages, it is very necessary to formulate countermeasures and put forward the concept of omni-directional nursing. But there are lack of studies and reports on the use of QCC in traumatic orthopedic patients [8]. Here, 134 patients with orthopaedic trauma surgery diagnosed and treated in our hospital from January 2019 to June 2020 were analyzed retrospectively to explore the effect of QCC in nursing of orthopaedic trauma surgery.

Materials and methods

General information

The clinical data of 134 cases of traumatic orthopedic patients diagnosed and treated in our hospital from January 2019 to June 2020 were retrospectively analyzed. Patients were assigned into two groups according to different nursing methods, with 67 cases in each group. The control group (CG) received traditional nursing, while the study group (SG) received additional QCC.

Inclusion criteria: (1) Patients were diagnosed as traumatic fracture by imaging examination [9]. (2) The hospital stays were more than 4 weeks. (3) Patients aged from 20 to 70. (4) Patients had normal cognitive function.

Exclusion criteria: (1) Patients had cardiac dysfunction or cardiovascular diseases. (2) Patients were infected before the study. (3) Patients had mental disorders. (4) Pregnant women. (5) Lactating mothers.

The informed consent forms were obtained, and this research was reviewed and approved by the Ethics Committee of Chun'an Hospital of Traditional Chinese Medicine (approval No. 20200032).

Methods

CG was mainly given routine nursing, including preoperative nursing (fixation of fracture, keeping respiratory tract unobstructed, oxygen inhalation, establishment of venous passage, preparation before operation), intraoperative nursing cooperation with doctors for monitoring vital signs during operation, and postoperative nursing (close observation of the condition and changes of vital signs of patients to avoid complications). Simultaneously, patients were given appropriate health education to appease their unease.

SG: combined use of QCC activities on the basis of routine nursing

Construction of QCC professional team: The QCC team was headed by a head nurse of the department, and nurses with professional training in QCC courses and rich clinical nursing experience. The project workflow was established to solve the problems that often occur in process nursing. The plan, do, check and act (PDCA) circulation method was followed in the process of implementation.

Improvement of working mode: The traditional night shift system was changed into a fixed nursing shift, and the existing beds were divided into four groups. Each group was headed by a fixed nursing staff, and each patient was equipped with at least two exclusive responsible nurses, so as to ensure that patients can find their own responsible nurses at the first time and solve problems in the nursing process in time. The nursing group was rotated once a month.

Regular monitoring of nursing quality: Every two weeks, the problems existing in nursing work, improvement of process, service attitude, application of nursing forms and procedures, were summarized and discussed. Then the workflow would be redesigned and formulated according to PDCA cycle method.

Enhancement of the health education of diseases: A health education list was made for related diseases, which was carried out by the responsible nurses and confirmed and signed by the patients and their families.

Continuous improvement of quality control: A nursing quality audit mechanism was constructed, the implementation details of a series of nursing activities were recorded and the problems were discussed in a centralized way by the nursing staff, so as to patrol the ward every day, check the nursing quality of the day, and solve the existing problems in time [11].

Psychological intervention: Orthopedic patients have relatively strong pain, and worry about the prognosis, resulting in a series of negative emotions, such as fear, anxiety and depression. The medical staff should actively communicate with patients, patiently answer their questions, dredge their negative emotions, introduce more successful treatment cases to them and their families, and build up their confidence in treatment [10].

Outcome measures

Pain (VAS) scores at each time point after operation: The scale scored 0 to 10 points in VAS: 0: painless, ≤3: slight pain, which can be tolerated; 4 points to 6 points: obvious pain, which has an impact on sleep, but can be tolerated; 7 points to 10 points: gradually intense pain, which affects normal appetite and sleep and is unbearable. Patients should evaluate their own pain scores and tell to the medical staff [12].

Two groups of negative emotion indicators: Anxiety self-rating scale (SAS) score and self-rating depression scale (SDS) score before and after intervention were evaluated. Before and after intervention, professional Self-Rating Scale (SAS) and Self-Rating Scale (SDS) were used to evaluate the psychological state of both groups. SAS score criteria: <50: normal, 50-59: slight anxiety, 60-69: moderate anxiety, ≥70: severe anxiety. SDS score criteria: <53: normal, 53-62: slight depression, 63-72: moderate depression, ≥73: severe depression [13].

Level of limb joint activity at each time point after operation: The measurement method of joint activity was as follows. When the limb was relaxed, the neutral position of the joint was taken as the reference. 0 degree of the joint was taken as the basis, and the joint angle was measured through flexion and extension, adduction, abduction, internal rotation, external rotation, lifting, varus and valgus using a joint angle ruler [14].

Awareness rate of health knowledge: It mainly included functional exercise, application of orthosis, nutrition knowledge and medication. The self-made evaluation scale of health knowledge awareness in our hospital was conducted to evaluate the awareness of related health knowledge in both groups. The score range of each dimension was 0-100, and the score of >80 points indicated that patients know the related health knowledge [15]. Awareness rate = number of people who know/total number *100%.

Satisfaction rate: The scores of satisfaction scale include four different grades: dissatisfied, generally satisfied, satisfied and very satisfied. The total satisfaction rate = (generally satisfied + satisfied + very satisfied)/total number of people *100%. The satisfaction questionnaire was completed by patients [16].

Quantitative scores of related quality of life indicators before and after intervention: The evaluation method was Barthel index, which covered social function, vitality, physical role, physical function, emotional role and mental health. The higher score indicated the higher quality of life [17].

Nosocomial infection rate of two groups: The type and quantity of nosocomial infection between both groups were statistically compared. Nosocomial infection rate = infection cases/total number *100%.

Statistical methods

SPSS 22.0 was applied for data analysis, and the measurement data were expressed by mean ± standard deviation ($\bar{x}$±sd). Independent sample t test was used for comparison between both groups, and paired t test was for that within the group. The counting data were represented as rate and compared by χ^2 test, and the comparison within groups was conducted by χ^2 test. P<0.05 indicated the difference was statistically significant.

Results

General information

In the CG, there were 67 cases, including 41 males and 26 females, with an average age of (45.2±2.7) years. Based on fracture types, there were 7 cases of multiple fractures, 5 of

Table 1. General information (%, $\overline{x}$±sd)

	Control group (n=67)	Study group (n=67)	χ^2/t	P
Gender (n)			0.124	0.725
Male	41	39		
Female	26	28		
Age (years)	45.2±2.7	44.9±2.5	0.667	0.506
Fracture types				
Multiple fractures (n)	7	8	0.075	0.784
Pelvic fractures (n)	5	6	0.099	0.753
Clavicle fractures (n)	18	17	0.039	0.844
Lower limb fractures (n)	19	18	0.037	0.847
Upper limb fractures (n)	18	18	0.037	0.847

Table 2. VAS score (score, $\overline{x}$±sd)

	Control group (n=67)	Study group (n=67)	t	P
Before intervention	7.15±1.06	7.09±1.21	0.305	0.761
2 weeks after intervention	6.05±0.84	4.98±0.75	7.778	<0.001

Table 3. Negative emotion indicators: SDS and SAS score (score, $\overline{x}$±sd)

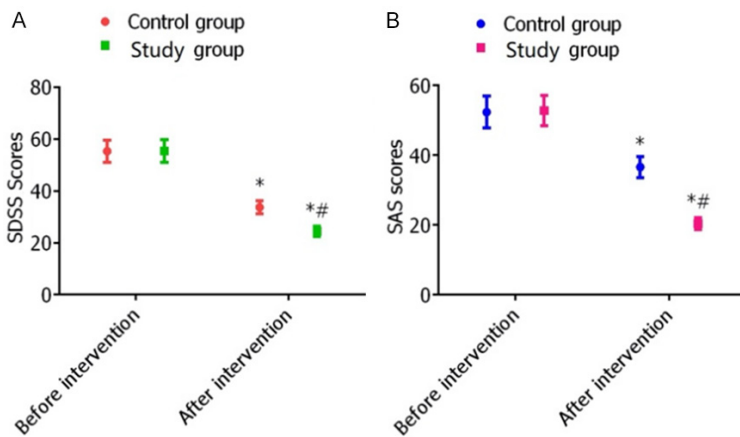|	Control group (n=67)	Study group (n=67)	t	P
SDS score				
Before intervention	55.32±4.25	55.43±4.36	0.148	0.883
After intervention	33.73±3.45	24.42±4.06	14.303	<0.001
SAS score				
Before intervention	52.35±5.18	51.78±4.35	0.690	0.492
After intervention	36.57±4.97	20.32±3.74	21.385	<0.001

Figure 1. Psychological fluctuation indicators: SDS score and SAS score. A: SDS score; B: SAS score. Compared with before intervention, *P<0.05; compared with control group, #P<0.05.

pelvic fractures, 18 of clavicle fractures, 19 of lower limb fractures, and 18 of upper limb fractures. There were 67 cases in the SG, including 39 males and 28 females, with an average age of (45.3±2.5) years. As for fracture types, there were 8 cases of multiple fractures, 6 of pelvic fractures, 17 of clavicle fractures, 18 of lower limb fractures, and 18 of upper limb fractures. There was no marked difference in baseline data between both groups (P>0.05; **Table 1**).

VAS score

There was no obvious difference in VAS scores between both groups before intervention (P>0.05). Two weeks after intervention, the VAS scores in the SG were lower than those in the CG (all P<0.05; **Table 2**).

Negative emotion indicators: SDS and SAS scores

Before intervention, there was no marked difference between both groups in negative emotion indicators, SDS quantitative and SAS quantitative score (all P>0.05). The quantitative scores of SDS and SAS in the SG were lower than those in the CG after intervention (all P<0.05; **Table 3** and **Figure 1**).

Limb joint activity

A total of 37 patients with lower limb fracture were included in this study, and limb joint activity test was mainly conducted for these patients. Before intervention, there was no marked difference in the limb joint mobility between both groups (P>0.05). After that, the level of limb joint activity in the SG was higher than that in the CG (all P<0.05; **Table 4**).

Table 4. Limb joint activity ($\bar{x}$±sd)

	Control group (n=19)	Study group (n=18)	t	P
Before intervention	46.84±4.78	46.45±4.21	0.783	0.435
2 weeks after intervention	62.31±5.84	74.98±6.75	11.619	<0.001
4 weeks after intervention	81.74±6.69	93.14±7.47	9.305	<0.001

Table 5. Awareness rate of health knowledge (n, %)

	Control group (n=67)	Study group (n=67)	χ^2	P
Functional exercise				
Before intervention	13 (19.40)	12 (17.91)	0.049	0.825
After intervention	51 (76.12)	63 (94.03)	8.463	0.004
Application brace				
Before intervention	11 (16.42)	12 (17.91)	0.053	0.819
After intervention	48 (71.64)	61 (91.04)	8.311	0.004
Nutrition knowledge				
Before intervention	12 (17.91)	14 (20.90)	0.191	0.662
After intervention	54 (80.60)	64 (95.52)	7.098	0.008
Common sense of medication				
Before intervention	18 (28.87)	17 (25.37)	0.039	0.844
After intervention	54 (80.60)	65 (97.01)	9.084	0.003

Table 6. Satisfaction rate

Group	Control group	Study group	χ^2	P
Case	67	67		
Very satisfied (n, %)	26 (38.81)	37 (55.22)		
Satisfied (n, %)	25 (37.31)	21 (31.34)		
Fair (n, %)	5 (7.46)	8 (11.94)		
Unsatisfactory (n, %)	11 (16.42)	1 (1.49)		
Satisfaction rate (%)	83.58	98.51	9.153	0.003

Awareness rate of health knowledge

Before intervention, no significant difference was found in the awareness rate of health knowledge between both groups (all P>0.05). After that, the SG had higher awareness rate of health knowledge than the CG (all P<0.05; **Table 5**).

Satisfaction rate

The satisfaction rate of the SG was higher than that of the CG (P<0.05; **Table 6**).

Quality of life

Before intervention, there was no significant difference in the scores of indicators in quality of life between both groups (all P>0.05). The score of each index in quality of life in the SG was higher than that in the CG (all P<0.05; **Table 7** and **Figure 2**).

Nosocomial infection rate

The nosocomial infection rate in the CG was 2.99% (2 cases), including 1 case of infection caused by poor wound care and 1 of upper respiratory tract infection. In the SG, the nosocomial infection rate was 1.49% (101 cases), and 1 case was upper respiratory tract infection. There was no marked difference in nosocomial infection rate between both groups (**Table 8**).

Discussion

Orthopaedic trauma surgery severely affect patients' psychological status and may cause emotional fluctuations in the process of clinical treatment and nursing, incluing fear, worry, depression and anxiety [16, 17]. It has been pointed out that negative psychological emotions will have an adverse impact on disease rehabilitation [18, 19]. This study suggested that the SDS and SAS quantitative scores of the SG after intervention were lower than those of the CG. QCC activity could improve the psychological mood of patients undergoing orthopaedic trauma surgery. In the process of clinical nursing work, QCC further enhanced the humanistic care of hospitals, so that patients could feel the care and warmth from clinical medical staff everywhere, thus making patients' negative psychological emotions more effectively alleviated. At the same time, combined with various related interventions, such as health education and psychological intervention, it fully embodied the positivity of the nursing team, and provided patients a harmonious atmosphere, so that they can better relieve their negative psychological emotions. This research also found

Table 7. Quality of life (score, $\bar{x}$±sd)

	Control group (n=67)	Study group (n=67)	X^2	P
Social function				
Before intervention	50.16±4.58	51.21±4.69	1.311	0.192
After intervention	65.87±5.69	80.46±5.97	14.481	<0.001
Vitality				
Before intervention	51.48±4.02	50.75±5.14	0.916	0.362
After intervention	64.57±4.58	81.45±5.95	18.401	<0.001
Body role				
Before intervention	52.64±4.57	51.79±3.98	0.202	0.840
After intervention	65.89±3.27	83.16±3.47	29.648	<0.001
Physical function				
Before intervention	51.48±5.85	50.82±6.46	0.620	0.536
After intervention	62.57±3.77	85.79±5.12	29.893	<0.001
Emotional role				
Before intervention	54.64±6.04	55.32±4.26	0.753	0.453
After intervention	67.85±5.59	84.63±6.57	15.922	<0.001
Mental health				
Before intervention	53.16±5.25	52.54±5.36	0.676	0.500
After intervention	64.75±6.36	86.31±7.59	17.822	<0.001

that the VAS score of the SG was lower than that of the CG 2 weeks after intervention. This may be associated with the fact that the implementation of QCC activities may take into account the pain timing of patients, while actively giving intervention can effectively reduce the pain score.

The awareness rate of health knowledge in the SG was higher than that in the CG. This may be that the health education list and unified and standardized nursing contents made in QCC provided corresponding reference basis for clinical nurses to implement health education [20, 21]. This can not only guarantee the health education behavior of nurses, but also further expand the coverage of health education [16].

The satisfaction rate of the SG was higher than that of the CG. This may be that QCC achieved holistic care in the implementation process, which made patients and medical staff closer, thus improving patients' satisfaction rate [22, 23]. Concurrently, through the implementation of QCC, the clinical nursing quality has been effectively improved, thus reducing the risk and rate of nursing omission, relieving the pressure and contradiction between nurses and patients, and improving the satisfaction rate.

The score of each index in quality of life in the SG was higher than that in the CG. Moreover, a

series of nursing rules and procedures in QCC greatly reduced the total negligence in the nursing process, thus improving the nursing quality, nursing effect and quality of life of patients [24]. This was consistent with the relevant research results, which pointed out that the use of QCC could effectively improve the clinical nursing quality of orthopedic patients and their satisfaction in different aspects, and effectively promote the improvement of orthopedic clinical nursing quality [25].

There was no significant difference in nosocomial infection rate between both groups. QCC is a novel nursing measure, and during the nursing process, it reduces the rate of wound site infection, which not only effectively ensures the safety of treatment of patients, but also effectively avoids complications. Through QCC activities, the key points and difficulties of nursing care were analyzed, and targeted intervention methods were formulated according to the actual situation of patients, which can not only effectively prevent the occurrence of related complications including nosocomial infection, but also effectively improve their self-care and management ability, and promote their rehabilitation.

The QCC activities adopted in this research paid more attention to the occurrence of problems in the whole nursing process. Through the close implementation of planning, implementation, inspection and treatment, it is easier to find a series of problems that patients may have in the early stage, so as to deal with them actively. It abandons the mechanical model of the traditional nursing model, and patients really experience love. Therefore, it is more conducive to improve the quality of nursing.

However, the limited research time and the small sample size may have an impact on the research results. The sample size was expected to increase and carry out further observation and research in the future. Also, this research only focuses on traumatic orthopedic patients in a certain hospital, and fails to collect relevant data in various specialized hospi-
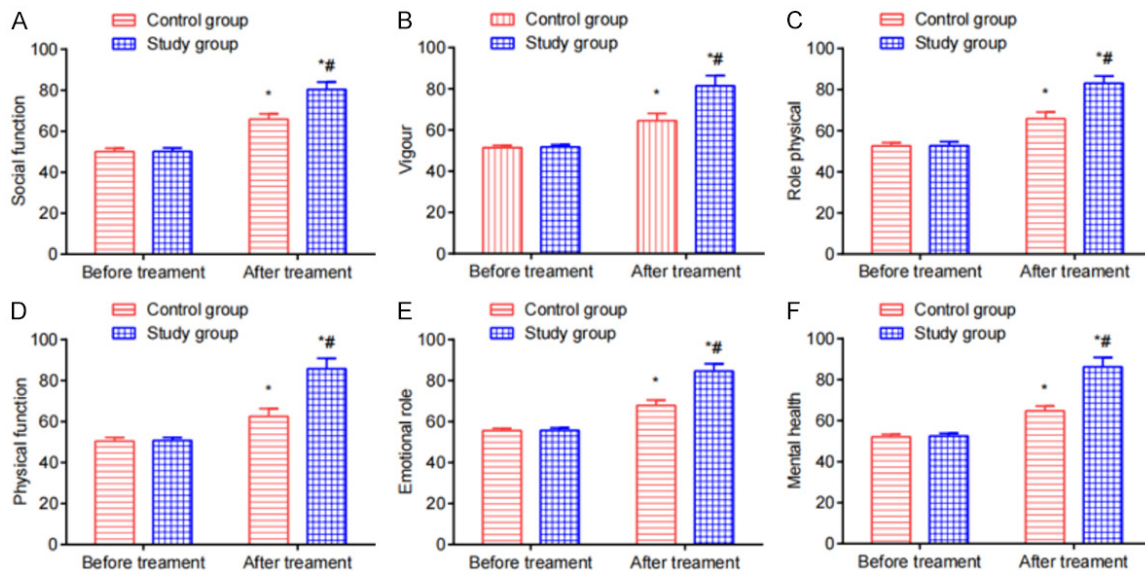
Figure 2. Comparison of the quality of life between the two groups. A: Social function; B: Vitality; C: Physical role; D: Physical function; E: Emotional role; F: Mental health. Compared with before treatment, *P<0.05; compared with control group, #P<0.05.

Table 8. Nosocomial infection rate

Group	Control group (n=67)	Study group (n=67)	X^2	P
Case	67	67		
Number of infection cases (n)	2	2	0.000	1.000
Infection rate (%)	2.99	1.94		

tals. Hence, the data obtained from this research was very limited, and there may be certain bias. If conditions permit, it is necessary to implement multi-center research, which will make the research data more detail and objective.

To sum up, the combined use of QCC in orthopaedic trauma surgery patients can reduce the pain of patients, reduce negative emotions, improve the mobility of limbs and joints, improve the awareness rate of health knowledge, the satisfaction rate and the quality of life, and reduce the infection rate as well.

Disclosure of conflict of interest

None.

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