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RESEARCH ARTICLE

Application of Quality Control Circle Activities in Improving the Integrity of Equipment Preparation for Posterior Cervical Surgery

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ABSTRACT

Objective: To explore the clinical effects of quality control circle (QCC) activities on the preparation of instruments, team cooperation and clinical satisfaction of posterior cervical surgery.

Methods: The clinical randomization table was used to select 100 patients who underwent posterior single open-door laminoplasty in the Department of orthopedics of our hospital from January 2020 to January 2021 as the study subjects. In the experimental group, quality control circle activities were used to prepare the surgical instruments before operation, including 32 males and 18 females, with an average age of 58.3 ± 10.5 years; The control group did not use quality control circle activities to prepare the surgical instruments before operation, including 27 males and 22 females, with an average age of 60.5 ± 9.8 years. First, the "quality control circle" activity group was established to carry out quality control circle activity steps such as theme selection, plan formulation, status analysis, goal establishment, problem rectification, specific implementation, effect evaluation and effect evaluation. The database was established by software, and the t-test and chi square test were used for statistical analysis to compare the pre-operative instrument preparation rate of the two groups of patients undergoing cervical posterior single open-door laminoplasty. Finally, the improvement of team consciousness, nursing knowledge, nursing quality, consciousness response and other qualities of all circle members in the experimental group before and after the use of quality control circle activities were analyzed, and the clinical satisfaction of patients and their families, anesthesiologists and chief surgeons with the operation and the integrity rate of equipment preparation were compared between the two groups.

Results: The overall integrity rate of the instruments in the experimental group was 90%, and the overall integrity rate of the instruments in the control group was 74%. The integrity rate of the instruments in the experimental group was significantly higher than that in the control group ($P < 0.01$). After the implementation of quality control circle activities, the team consciousness, nursing knowledge, nursing quality and consciousness reaction of the circle members in the experimental group were significantly improved compared with those before the implementation of quality control circle activities, and the difference between the two groups was statistically significant ($P < 0.01$). The overall satisfaction of patients and their families, anesthesiologists, and chief surgeons in the experimental group was 92%, 88%, and 90%, and that of the control group was 76%, 68%, and 74%, respectively. The overall satisfaction of the experimental group was significantly higher than that of the control group ($P < 0.05$); The integrity rate of surgical instruments preparation in the experimental group was 90%, and that in the control group was 74%. The experimental group was significantly higher than the control group ($P < 0.01$).

Conclusion: The application of quality control circle activities can improve the integrity of instrument preparation for posterior cervical surgery, improve the satisfaction of patients, family members and medical staff, and improve the quality of surgical care.

Keywords: Posterior cervical surgery; Instrument preparation; Quality control circle activities

1. Introduction

Posterior single open-door laminoplasty is a common surgical method in spinal surgery. The good cooperation of surgeons, anesthesiologists and nurses is the key to the success of the operation, and the effective preparation of surgical instruments is also a very important link. In some provincial-level third-class hospitals, due to the large number of patients in the operating room, the large workload, and the high rate of imperfect pre-operative equipment preparation, the operation may not be carried out smoothly. The posterior single open-door laminoplasty of cervical spine requires high preparation of pre-operative instruments and uses many special instruments. Once the preparation is not perfect, the operation process will be prolonged, the operation risk and difficulty will be increased, and the occurrence of postoperative complications will be increased. The satisfaction of operators, anesthesiologists, patients and their families may also be decreased. As a relatively flexible nursing mode, quality control circle (QCC) activity refers to an activity group that is spontaneously organized by personnel related to the nature of work, and uses scientific management tools to improve work quality and efficiency. Through team cooperation, it is not only beneficial to find and rectify various problems in clinical nursing, improve the subjective initiative of all members, and strengthen the communication among nurses, but also conducive to the establishment of team spirit and the formation of hospital management culture. Once introduced into hospital management, it has been widely used in various departments and achieved good results¹. It is also commonly used in orthopedics, including the handover time of orthopedic surgery, preoperative preparation, and surgical nursing of elderly patients²⁻⁴. The operating rooms of our hospital have been using QCC since April 2015, aiming to replace the traditional empiricism through flexible use of scientific tools, and the problems existing in the preparation of posterior

cervical surgical instruments have been counted, analyzed, and improved, and achieved good results. The report is as follows.

2. Materials and Methods

2.1 General information

Based on the experience and methods of Kendall multiple linear regression for sample content estimation, 10-20 times the number of variables were desirable. According to this, the sample size is 30-70 people. In order to reduce errors and sample loss, the sample size of each group in this study was at least 50 people. Using the clinical random table method, 50 patients who underwent posterior cervical single open-door laminoplasty in the Department of Orthopedics of our hospital from January 2020 to January 2021 were selected as the experimental group. Before surgeries, the surgical instruments were prepared with QCC, including 32 males and 18 females, with an average age of 58.3 ± 10.5 years. According to the same method, 50 patients who underwent the same operation were selected as the control group. Before surgeries, the surgical instruments were prepared without QCC, including 27 males and 22 females, with an average age of 60.5 ± 9.8 years.

2.2 Methods

2.2.1 Establish a quality control circle

By the principle of initiative and voluntariness, three nurses in the operating room, four surgeons, and one anesthesiologist spontaneously formed a quality control circle. They elected a circle leader by a show of hands. The circle leader should have rich experience in preparing preoperative instruments for posterior cervical single open-door laminoplasty and be responsible for administering instrument preparation in the perioperative period. The circle members are accountable for the specific implementation work.

2.2.2 Theme selection and planning

By using the method of collective discussion, the theme was timely selected as the management of orthopedic surgical instruments in cervical posterior single door laminoplasty. Then use brainstorming to analyze and discuss the problems in preparing preoperative instruments, and summarize the circle leader. Finally, all circle members determine the circle name and emblem, and establish files for future summary and analysis.

2.2.3 Current situation analysis and goal establishment

According to the survey, the integrity rate of surgical instruments preparation of 50 patients with posterior cervical surgery in the control group was 74%, and the satisfaction of patients and their families was 76%. List all the problems existing in the preoperative preparation of posterior cervical surgery, and set reasonable target values according to the results of the current situation investigation.

2.2.4 Problem rectification and specific implementation

Practical improvement methods are put forward to aim at the problems found by quality control circle (QCC) activities. It is necessary to strengthen the training of nursing staff, strengthen the communication and communication between the nursing staff and the doctor in charge of the patient, and fully understand the habits and preferences of the surgeon. Regularly organize the operating room personnel to get familiar with and learn to use the surgical instruments, for those routinely used instruments, they should be repeatedly explained and informed to impress them and consciously form a conditioned reflex. For those instruments that are not often used, they should take pictures and learn to be familiar with them in scattered time; Formulate new rules and regulations and the preparation process of posterior cervical surgery instruments, and

repeatedly inform the instrument nurses to prepare in strict accordance with the procedures and check again according to the guidelines after surgery; Use the scattered time to maintain cervical posterior surgical instruments, to become very familiar with the instruments that need to be prepared before the surgery, and reduce the occurrence of inadequate preoperative preparation; Communicate with the device manufacturer in detail before surgery, and be familiar with whether there are special devices that need to be prepared during the surgery.

2.2.5 Effect evaluation

(1) Comparing the improvement of equipment preparation before posterior cervical single open-door laminoplasty by the equipment nurses in the operating room of the two groups; (2) Evaluate the quality of circle members (including team consciousness, nursing knowledge, nursing quality, and consciousness response); (3) Score the satisfaction of anesthesiologists, surgeons, patients, and their families before and after using QCC. The self-designed "patient and medical staff satisfaction questionnaire" was used to investigate the inpatients, family members, anesthesiologists and chief surgeons. The full score was 100 points. The higher the score, the higher the patient satisfaction. Including dissatisfaction (less than 60 points), basic satisfaction (60-80 points), high satisfaction (80-100 points), and the overall satisfaction is the sum of basic satisfaction scores and high satisfaction scores.

2.2.6 Statistical methods

After sorting the obtained data, statistical analyses were conducted using the SPSS statistical package 17.0 software. T-test and Chi-square test were used for statistical analysis, and a P -value < 0.05 was considered significant.

3. Results

3.1 The integrity rate of preoperative instruments preparation for posterior cervical single open-door laminoplasty in the two groups

The overall integrity rate was 74% before using QCC and 90% after using QCC, and the difference between the two groups was statistically significant ($P < 0.05$), see Table 1.

Table 1. The integrity rate of surgical instruments in the two groups.

Group	No. of total cases (n)	Headframe (%)	Grinding drill (%)	Disinfection supplies (%)	Instrument set (%)	Total (%)
Experimental group	50	98	96	98	94	90
Control group	50	80	82	82	84	74
χ^2		16.547	10.010	14.222	5.107	8.672
P-value		<0.01	<0.01	<0.01	<0.05	<0.01

3.2 The quality of all circle members before and after using QCC

The scores of team consciousness, nursing knowledge, nursing quality, and consciousness

response of circle members before and after the implementation of QCC are shown in Table 2. The difference was statistically significant before and after using QCC ($P < 0.01$).

Table 2. The quality of all circle members before and after using QCC.

Item	Before implementing QCC	After implementing QCC	T-value	P-value
Team consciousness	6.12±0.83	7.62±0.74	-3.975	<0.01
Nursing knowledge	5.12±0.64	7.25±0.89	-5.495	<0.01
Nursing quality	5.63±1.06	8.12±0.83	-5.239	<0.01
Consciousness response	5.25±0.71	7.75±0.89	-6.236	<0.01

3.3 The overall satisfaction of patients and their families with the surgery in the two groups

The satisfaction rate of patients and their families in the experimental group was 92% (46 /

50); The satisfaction rate of patients and their families in the control group was 76% (38 / 50). There was a significant difference between the two groups ($P < 0.01$). See Table 3.

Table 3. The overall satisfaction of patients and their families with the surgery in the two groups.

Group	No. of total cases (n)	Dissatisfied (n)	Basically satisfied (n)	Very satisfied (n)	Overall satisfaction (n)
Experimental group	50	4	35	11	46
Control group	50	12	28	10	38
χ^2		2.041	2.102	0.06	4.762
P-value		<0.05	>0.05	>0.05	<0.05

3.4 The overall satisfaction of anesthesiologists with the surgery in the two groups

The satisfaction rate of anesthesiologists in the experimental group was 88% (44 / 50); The

satisfaction rate of anesthesiologists in the control group was 68% (34 / 50). There was a significant difference between the two groups ($P < 0.05$). See Table 4.

Table 4. The overall satisfaction of anesthesiologists with the surgery in the two groups.

Group	No. of total cases (n)	Dissatisfied (n)	Basically satisfied (n)	Very satisfied (n)	Overall satisfaction (n)
Experimental group	50	6	31	13	44
Control group	50	16	24	10	34
χ^2		5.828	1.98	0.508	5.828
P-value		<0.05	>0.05	>0.05	<0.05

3.5 The overall satisfaction of the chief surgeons with the surgery in the two groups

The satisfaction rate of the chief surgeons in the experimental group was 90% (45 / 50); The

satisfaction rate of the chief surgeons in the control group was 74% (37 / 50). There was a significant difference between the two groups ($P < 0.05$). See Table 5.

Table 5. The overall satisfaction of the chief surgeons with the surgery in the two groups.

Group	No. of total cases (n)	Dissatisfied (n)	Basically satisfied (n)	Very satisfied (n)	Overall satisfaction (n)
Experimental group	50	5	33	12	45
Control group	50	13	31	6	37
χ^2		4.336	0.174	2.439	4.336
P-value		<0.05	>0.05	>0.05	<0.05

4. Discussion

Quality control circle activities have been popularized and applied in hospitals at all levels and achieved remarkable results, significantly improving the treatment effect and work efficiency⁵⁻⁷. This study focuses on improving preoperative instrument preparation for posterior cervical single open-door laminoplasty. It is found that after the use of QCC, the overall satisfaction of family members, anesthesiologists, and chief surgeons with the operation and the integrity rate of preoperative instruments preparation are significantly improved, the omission and error of instruments are reduced, and the improvement rate of instrument preparation is increased from 74% to 90%.

Quality control circle activities help cultivate the team spirit of operating room nurses^{8,9}. Due to the nursing staff shortage in our hospital's operating room, the workload is large, and the individualism is relatively heavy. Through this activity, we gather our thoughts in a broad sense and further improve the team consciousness, enhancing the enthusiasm and initiative of nursing staff to learn professional knowledge. Before using QCC activities, nursing staff only acquired knowledge through self-study and obtained professional knowledge through books or the Internet. The amount of information is large, the focus is not prominent enough, and memory difficulty is the main problem. However, after the

implementation of QCC, the circle members complement each other's knowledge, supervise and help each other, and repeatedly emphasize the critical knowledge, which improves the learning efficiency and makes the memory of professional knowledge stronger. The storm communication among the circle members increased team awareness, and enhanced expertise has also improved the quality of nursing to a certain extent.

For continuous operating room nursing work, a reasonable integrity rate of preoperative instruments preparation rate plays a vital role in the entire operation process, which is directly related to the smoothness of the operation, the mood of the operator and the anesthesiologist, and also plays a good start for the whole nursing work¹⁰. The nursing work in the operating room is often in a hurry. Nurses usually prepare preoperative instruments based on memory and experience. At the same time, instrument nurses are sometimes disturbed by machine alarm, environmental change, instrument placement in the storage room, damage and loss of conventional instruments, etc., which is prone to omission or inadequate preparation. Even some nurses do not find the omission of instruments until after hand brushing and disinfection, which directly affects the smooth progress of the operation. QCC members scientifically analyze the problem to find the most direct factors leading to insufficient work and adopt efficient problem-solving methods to avoid

errors and omissions, with remarkable results.

This quality control circle activity standardized the specification and process of preoperative instrument preparation for posterior cervical single open-door laminoplasty. Nurses' awareness of the integrity rate of preoperative instruments preparation was strengthened so that nurses could more clearly understand the critical contents of it and have evidence to rely on, which significantly improved the quality of preoperative instrument preparation, promoted the implementation of nursing measures, and enhanced the responsibilities of the instrument nurses in the department and QCC members. The 100% perfection of instrument preparation for posterior cervical single open-door laminoplasty can speed up the operation, improve the nursing quality in the operating room¹¹, and avoid intraoperative and postoperative complications caused by poor or even improper instrument preparation.

We incorporated the content and process of preoperative instrument preparation for posterior cervical single open-door laminoplasty in the operating room nurses' job responsibilities and quantitative assessment rules to form a standardized work specification. Based on this, the head nurse inspects, supervises, and evaluates all instrument nurses and achieves consolidation of results and continuous improvement through project standardization¹². At the same time, detailed plans and contents have been formulated. Each time, the preparation shall be checked item by item. After confirmation, the second or third party shall sign on the preoperative instrument preparation sheet. The original shall be handed over to the itinerant nurse for medical records, and the original copy shall be taken back to the operating room for archives. The use effect of this record sheet is good, effectively avoiding the occurrence of omissions in preoperative instrument preparation.

Quality control circle activities help to improve nurses' team spirit and comprehensive ability. Literature¹³ reported that the

implementation of QCC can exercise and enhance nurses' management ability and enhance their sense of self-responsibility and pride. In the process of carrying out QCC activities, our department starts by respecting human nature, giving the circle members a real sense of participation, making the circle members' values get the best play, and creating a pleasant working environment for them so that they can feel satisfied and fulfilled in their work, to improve the work quality¹⁴, enhance the sense of work responsibility and give play to the team spirit, it has fully mobilized the work enthusiasm and creativity of nurses and further enhanced the status of nurses in the whole medical activities¹⁵. In addition, the circle members also learned to use QCC working methods to solve the problems encountered in nursing work, improve scientific research thinking ability, stimulate the awareness of nursing staff to participate in quality management, and strengthen the execution of nursing management. QCC activity is an effective way to improve the problem-solving ability of nurses¹⁶⁻¹⁸, which is worthy of further promotion and reference in medical and clinical work.

5. Conclusion

The application of quality control circle activities can improve the integrity of instrument preparation for posterior cervical surgery, improve the satisfaction of patients, family members and medical staff, and improve the quality of surgical care. In general, quality control circle activity is a flexible nursing model, which is worth popularizing and applying in clinic.

Supplementary Materials: All materials are presented in the submitted article.

Author Contributions: Conceptualization, Yan Jiang; data curation, Chaoran Wang and Guangli Mi; writing—original draft preparation, Yan Jiang and Juan Li; writing—review and editing, Shuling

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was obtained from all subjects involved in the study, and written informed consent was obtained from the patients to publish this paper.

Data Availability Statement: The data presented in this study are available in the submitted article.

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