

ORIGINAL RESEARCH

Nursing Team Training and Standardized Management in Hybrid OR

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ABSTRACT

Objective • Analyzing the impact of nursing workforce development, training and standardization on hybrid operating theatres

Methods • Thirty nurses in the mixed operating room of the First Affiliated Hospital of Nanchang University from January 2021 to December 2021 were selected as the control group to receive routine nursing management and training methods and another thirty nurses were selected as the experimental group to receive nursing team construction, training and standardized management based on conventional methods. Nurses' theoretical and operational scores, nurses' satisfaction, surgeon satisfaction with nurses, and nursing service quality scores were compared between two groups at baseline and after intervention.

Results • After the intervention, nurses in both groups had a significant improvement in theoretical and operational scores than those at baseline, and nurses in the experimental group had better scores than those in the control group. The difference was statistically significant

($P = .002, P = .004$). Nursing quality of surgical preparation, environmental management, surgical safety, and instrument management in the intervention group were significantly better than those at baseline and better than those in the control group. The difference was statistically significant ($P = .001, P = .001, P = .001, P = .001$). Satisfaction of nurses and doctors in the intervention group was significantly better than those at baseline and better than those in the control group. The difference was statistically significant ($P = .002, P = .001$).

Conclusion • The effect of nursing team construction and training and standardized management of hybrid operating Room was ideal, which can improve nurses' theoretical knowledge and practical skills, and enhance the satisfaction of nurses and surgeons, providing patients with higher quality nursing services, which is worth adopting. (*Altern Ther Health Med.* 2024;30(10):498-503).

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INTRODUCTION

The operating room is an important place for the hospital to provide surgery and rescue for patients. It is an important hub for the operation of the hospital surgery, and also the main technical department and platform department of the hospital. The scientific and efficient management of the operating room is crucial to the overall efficiency of surgery and related departments. In the traditional process, critical patients had to be transferred to the hospital emergency room, then transferred

to the imaging center, and finally transferred to the operating room.¹ The medical efficiency of this medical process is low, and there are certain medical quality and medical safety risks, which will affect the treatment of critical patients.²

A hybrid operating room is a medical facility that integrates advanced imaging equipment and information technology with interventional therapy technology and the equipment of a sterile operating room. This allows medical professionals to perform imaging diagnosis, interventional therapy, and surgical procedures simultaneously.³ Hybrid operating rooms can treat complex diseases with interventional and surgical techniques, and patients do not need to be transferred between the operating room and the imaging examination room multiple times, to avoid the risks of infection, hypoxia, and fluctuation of vital signs during the transfer. It has the characteristics of low trauma, good curative effect, and rapid recovery, which improves the safety of surgery and conforms to the trend of the development of modern medicine.⁴ At present, the domestic hybrid operating room is still in the early stage of formation and establishment,

and there are still many deficiencies that need to be improved in various clinical equipment.⁵ Therefore, it is our common goal to establish a standardized management model for hybrid operating rooms. The operations carried out in hybrid operating rooms are relatively complex, which determines to a certain extent that nurses need systematic training to be competent in nursing. The construction of a stable and mature nursing team and the exploration of a relatively perfect nursing team training model have a positive effect on the smooth promotion of hybrid operating room operations.⁶ This article focuses on the application effect of standardized management and nursing team construction and training in hybrid operating rooms.

MATERIALS AND METHODS

General Information

Out of the 78 nurses who enrolled in this study, 10 were excluded from 3 months of the internship because they were school interns, 8 withdrew from nursing midway, and 60 cases were included. A total of 30 nurses in the hybrid operating room of Department of Anesthesia Surgery, the First Affiliated Hospital of Nanchang University from January 1 to December 31, 2019, were selected as the control group, including 3 males and 27 females. The average age was (39.28±3.10) years old, ranging from 34 to 48 years old. The average length of work was (11.35±2.48) years, ranging from 6 to 20 years. Professional titles: 3 nurses, 21 senior nurses, and 6 senior nurses in charge. A total of 30 nurses in the hybrid operating room of the Department of Anesthesia Surgery, the First Affiliated Hospital of Nanchang University from January 2020 to December 2020 were selected as the experimental group, including 3 males and 27 females; The average age was (38.86±3.54) years old, ranging from 34 to 46 years old. The working years ranged from 6 to 18 years, with an average of 10.85±2.30 years. Job title: 4 nurses, 20 senior nurses, and 6 senior nurses in charge. There were no significant differences in baseline data between the two groups (all $P > .05$), which were comparable. The study was approved by the ethics committee of the First Affiliated Medicine of Nanchang University.

Inclusion criteria

(1) All of them were nurses in the hybrid operating room of our hospital; (2) Aged ≥18 years old, and obtained the nurse practice qualification certificate; (3) Informed consent was obtained from nurses, and they voluntarily participated in the study.

Exclusion criteria

(1) Unable to fully participate in the study due to communication or illness; (2) those who asked for leave during the study; (3) refuse or withdraw from the study.

Methods

The control group adopted routine nursing management and training methods, that is, the nurses in the hybrid operating room carried out various operations strictly

Figure 1. Layout of the hybrid operating room for transcatheter aortic valve replacement

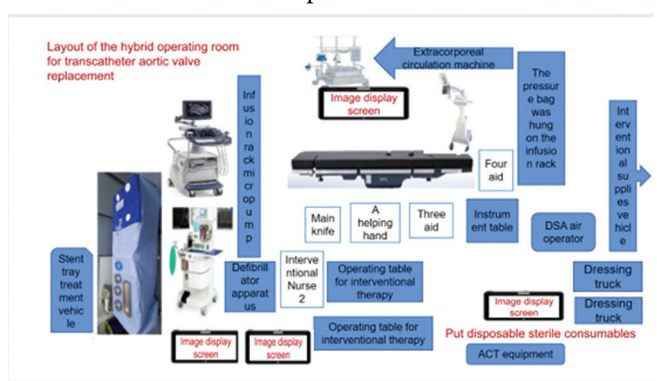
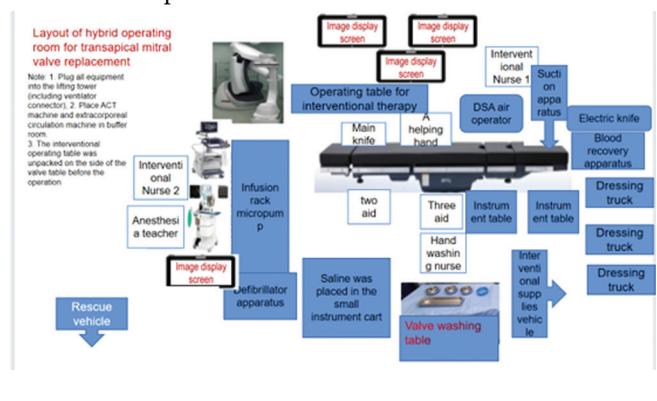


Figure 2. Layout of the hybrid operating room for transcatheter mitral valve replacement



according to the department management standards, and the head nurse trained other nurses in the department. The main training content was the work content, process, operation standards, and precautions of the hybrid operating room. Only those who pass the examination can carry out follow-up nursing work. The intervention lasted for 4 weeks.

The experimental group adopted the standardized management of the hybrid operating room and the construction and training of the nursing team. The main methods were as follows: (1) Standardized nursing management of hybrid operating room: due to the limited resources in the operating room, it was necessary to make a reasonable layout of the hybrid operating room and formulate a detailed distribution map (Figure 1, 2) to ensure the orderly discharge, so that the operation could be carried out smoothly; The surgical valuables in the composite operating room should be managed by a special person. The “Interoperation Day Checklist” should be set up to record the types, numbers, and times of use of valuables. Combined with different specialties, different parts of the operation, and different left and right operations, the operating table, anesthesia machine, crane, instrument table, digital subtraction angiography machine, 64-row slide CT, 3.0 magnetic resonance imaging and video processing system were positioned, and various surgical space layout maps were generated.

Team members discussed and analyzed the relevant responsibilities of instrument nurses, circuit nurses, and

nursing managers, and strictly followed the principles of scientific, integrity, orientation, practicability, and practicality to modify and improve them constantly. (2) Construction and training of hybrid operating room nursing team: (A) Construction of hybrid operating room nursing team: First, the nurses with strong professional ability, a strong sense of responsibility, high educational level, high seniority, certain English foundation, and rich experience in interventional operation should be selected to construct the relevant surgical nursing team of the hybrid operating room and the relevant surgical nursing training work in the hybrid operating room should be organized and planned. The nursing managers were clinical nurses with rich experience in cardiopulmonary bypass surgery and interventional surgery and participated in team building. (B) The operation nursing training of hybrid operating room: the main training plan was presided over by the hybrid operating room nursing manager, and the clinical nursing workers participated in the development of general and professional training-related plans; The main training content is to master the relevant knowledge of hybrid operating room through on-site training, network learning and assessment, participate in the relevant theoretical training of training institutions, carry out the relevant operation training of hybrid operating room on the site of training institutions, carry out simulation operation, guide the new and carry out one-on-one on-site teaching, centralized training and continuous improvement. Problem-based video teaching, scenario simulation, problem-based and case-based teaching, standardized patients, and other teaching methods were used to carry out training. The intervention lasted for 4 weeks.

Evaluation indicators

The theoretical and operational assessment results, nurses' satisfaction, surgeons' satisfaction with nurses, and nursing quality scores were compared between the two groups. (1) Theoretical and operational assessment: theoretical and operational assessments were carried out before the intervention and 4 weeks after the intervention in the two groups. The theoretical assessment was carried out by closed-book examination, and the content was about the theoretical knowledge of hybrid operating room nursing. The total score was 100 points, and the higher the score, the better the assessment results. The operation assessment was carried out by the head nurse of the department, and the nursing cooperation technology of any specialized operation in the composite operating room was selected for assessment. After the assessment, the head nurse gave a score, the full score was 100 points, and the higher the score, the better the assessment results. (2) Satisfaction of nurses: The self-designed satisfaction questionnaire was used to evaluate the two groups of nurses, including training content and training methods. The total score was 100 points, ≥90 points were satisfied, 80-90 points were general, < 80 points were not satisfied, satisfaction = satisfaction, and general satisfaction number/total number×100%, the internal reliability and validity of the questionnaire were tested. The Cronbach coefficient was 0.812, and the content validity

Table 1. Comparison of theoretical and operational assessment results between the two groups ($\bar{x} \pm s$, score)

groups	Number of cases	Theoretical examination		operation examination	
		Before intervention	After intervention	Before intervention	After intervention
Experimental Group	30	80.26±2.17	96.38±3.12 ^a	79.35±2.56	94.30±3.95 ^a
Control group	30	81.37±1.26	90.45±4.20	80.28±1.89	88.35±4.20
t		3.737	3.584	2.468	3.263
P value		.064	.002	.074	.004

^aCompared with before intervention, $P < .001$

Table 2. Comparison results of nurses' satisfaction between the two groups (example, %)

groups	Number of cases	Satisfied (%)	General (%)	Dissatisfied (%)	Satisfied (%)
Experimental Group	30	24(80.00)	4(20.00)	2(0.00)	28(93.33)
Control group	30	12(40.00)	6(20.00)	12(40.00)	18(60.00)
Z/χ ²			-3.343		9.317
P value			0.001		.002

was 0.796. (3) Surgeons' satisfaction with nurses: A self-designed satisfaction questionnaire was used to evaluate the satisfaction of surgeons with nurses in the two groups, involving nursing management mode, surgical cooperation, and other items. The total score was 100 points, ≥ 90 points were satisfied, 80-90 points were general, <80 points were dissatisfied, satisfaction = satisfaction, and general satisfaction number/total number×100%, the internal reliability and validity of the questionnaire were tested. The Cronbach coefficient was 0.820, and the content validity was 0.798. (4) Nursing quality score: The evaluation items included surgical preparation, environmental management, surgical safety, and instrument management. Each item was taken on a 10-point scale, and the higher the score, the better the quality of nursing work. The internal reliability and validity of the questionnaire were good, the Cronbach coefficient was 0.846, and content validity was 0.805.

Statistical analysis

Data were entered by two people into Statistic Package for Social Science (SPSS) version 23.0 software (IBM, Armonk, NY, USA) and analyzed. Categorical data and ranked data were expressed as rates or percentages. Categorical data were tested by the χ² test and ranked data were tested by the rank sum test. Numerical data with normal distribution were expressed as ($\bar{x} \pm s$), two independent sample t tests were used for inter-group comparison, and two paired sample t-tests were used for intra-group comparison. Data that did not meet the normal distribution were analyzed by M (P25, P75) and rank sum test. The test standard was two-sided α=0.05, and $P < .05$ was considered statistically significant.

RESULTS

Comparison of theoretical and operational assessment results between the two groups

The scores of theoretical assessment and operation assessment in the experimental group were higher than those in the control group and before the intervention, and the differences were statistically significant ($P < .05$), as shown in Table 1.

Table 3. Comparison of the satisfaction of the two groups of surgeons with the two groups of nurses (example, %)

groups	Number of cases	Satisfied (%)	General (%)	Dissatisfied (%)	Satisfied (%)
Experimental Group	30	21(70.00)	6(30.00)	3(0.00)	27(90.00)
Control group	30	9(30.00)	9(30.00)	12(40.00)	18(60.00)
Z					3.259
P value					.001

Table 4. Comparison of nursing quality scores between the two groups ($\bar{x} \pm s$, score)

groups	Number of cases	Preparation for Surgery		Environmental management		Safety of surgery		Device management	
		Before intervention	After intervention	Before intervention	After intervention	After intervention	After intervention	Before intervention	After intervention
Experimental Group	30	7.45±0.65	9.14±0.56	6.45±0.37	9.06±0.52	7.38±0.21	9.20±0.62	7.87±0.45	9.34±0.50
Control group	30	7.21±0.34	7.64±0.40	6.37±0.28	7.58±0.45	7.16±0.48	7.40±0.52	7.59±0.37	8.02±0.48
t		0.038	6.983	0.526	6.806	0.034	7.034	0.079	6.022
P value		.064	.001	.053	.001	.065	.001	.075	.001

^aExperimental group, after intervention compared with before intervention, all $P < .001$

Comparison of satisfaction between the two groups of nurses

The satisfaction of nurses in the experimental group and the control group were 93.33% and 60.00%, respectively. The satisfaction of nurses in the experimental group was higher than that in the control group, and the difference was statistically significant ($P < .05$), as shown in Table 2.

Comparison of surgeons' satisfaction with nurses in the two groups

The satisfaction of surgeons to nurses in the experimental group and the control group was 90.00% and 60.00%, respectively. The surgeons' satisfaction with the nurses in the experimental group was higher than that in the control group, and the difference was statistically significant ($P < .05$), as shown in Table 3.

Comparison of nursing quality scores between the two groups

The nursing quality scores of surgical preparation, environmental management, surgical safety, and instrument management in the experimental group were higher than those in the control group and before the intervention, and the differences were statistically significant ($P < .05$), as shown in Table 4.

DISCUSSION

The standardized management of hybrid operating rooms can effectively improve the quality of clinical nursing.

The rise of the operation mode of hybrid operating rooms conforms to the trend of modern medicine and meets the needs of patients. At the same time, we will also face many challenges at the same time of technological innovation, such as the nursing and management problems after the establishment of the hybrid operating room, we need to constantly learn and think. All kinds of new technologies carried out in hybrid operating rooms have posed severe challenges to the nursing management of the department, which requires us not only to operate strictly according to the operating procedures but also to fully grasp the characteristics of the operation.^{7,8} Secondly, the quality of nursing in the operating room directly affects the success rate of treatment

and rescue of patients, and the quality of nursing plays a crucial role in the work of the operating room.⁹ In this study, through the implementation of standardized management of a hybrid operating room, the quality of clinical nursing was significantly improved compared with that before intervention and that of the control group, and the difference was statistically significant. The nursing quality scores of operation preparation, environmental management, instrument management, operation safety, and other dimensions are higher than the domestic level in the same period, which is consistent with the research results of Yan Ang, et al.,¹⁰ indicating that it is very necessary and effective to implement standardized management of the hybrid operating room. The reasons for the analysis may be as follows: First, there are many instruments and equipment required in the hybrid operating room, so it is very important to place the instruments orderly and neatly in the limited indoor space. In this study, through the formulation of layout drawings and clear positioning and processing of instruments, the placement of various instruments is specified. It is very convenient and fast for nurses to assist doctors in accessing instruments and instruments during the operation, which saves operation time. It makes the cooperation during the operation not chaotic and orderly. For the patients, the operation process is closely connected, and the operation time is accurately consumed, which has a helping effect on the development of the operation and the success rate of rescue. Secondly, the instruments and equipment required by the hybrid operating room are sophisticated and valuable, and the damage or loss of any part may lead to instrument failure. If it is found during the operation, it will lead to serious consequences of forced surgical interruption of the patient's operation. Therefore, preoperative inspection and dedicated management are very important.^{11,12} In this study, special personnel were responsible for the management of surgical valuables, and the responsibility was implemented to individuals. At the same time, the "interoperation day Checklist" was set up to check the instruments and equipment every day, and timely maintenance was performed if the instruments were found to be running disorders, to ensure that the instruments were in good condition before the operation and the operation was carried out and completed

smoothly. Finally, the orderly and standardized placement of surgical instruments, surgical environment management, and instrument management will save a lot of unnecessary trouble, and the score of nursing quality will be significantly improved. With the standardized management of a hybrid operating room, the operation of nurses with doctors is very smooth, which will virtually improve the satisfaction of nurses and doctors.

Standardized training in hybrid operating rooms can effectively improve the theoretical and practical level of clinical nurses.

The theoretical and practical level of nurses determines the quality of clinical nursing. Standardized training for nurses is an effective method. In this study, through the standardized training of nurses in the experimental group, their theoretical and operational practice levels were significantly improved compared with those before intervention and those in the control group, and the difference was statistically significant. It shows that the characteristic standardized training program developed for hybrid operating rooms can significantly improve the theoretical and practical level of nurses. With the rise of hybrid operating room operation mode, traditional standardized training is difficult to meet its requirements in terms of mode and content. In this study, the training plan and content are formulated by managers and clinical nurses, which can not only be controlled from the general direction and main content but also be clinical-oriented by the participation of clinical nurses. Develop targeted training programs and content; Secondly, various forms of training methods should be carried out. For example, to enable nurses to fully understand and skillfully operate, manufacturers should be invited for on-site training; At the same time, the current emerging and effective training methods such as simulation operation, video teaching, scenario simulation exercise, standardized patients, etc., should be absorbed and used for reference to enrich the training methods, so that clinical nurses have more opportunities to acquire more knowledge in the training methods suitable for their characteristics, and check the gaps and fill the gaps. The training content is highly targeted, and the training methods are diversified. Scientific teaching methods and models are adopted to carry out planned, targeted, and stepwise training for team members in line with the characteristics of subspecialty nursing in the operating room so that the nursing team in the compound operating room is gradually expanded, the stable and high-quality nursing cooperation effect is maintained, and the details of nursing cooperation are constantly innovated. In addition, it can continuously improve the knowledge level and working ability of nurses,^{13,14} which ensures that the standardized training of hybrid operating rooms can effectively improve the theoretical and practical operation level of nurses, to improve the quality of surgical nursing.

The standardized management and training of hybrid operating room can effectively improve the satisfaction of medical staff

The satisfaction of nurses in the experimental group and the control group were 93.33% and 60.00%, respectively. The satisfaction of nurses in the experimental group was higher than that in the control group ($P < .05$), which reflected that standardized management, nursing team construction, and training in the hybrid operating room can improve the satisfaction of nurses. The reason is that by building the hybrid operating room nursing team and formulating the corresponding training plan and then adopting a variety of training methods, the nurses' interest in learning can be secondary. During the training period, the nurses can help them master the relevant knowledge of the hybrid operating room more comprehensively and deeply, and develop their working ability so that they can better cooperate with the surgeons to complete the operation in the usual work. Satisfactory nursing services can be provided to patients, which is highly recognized by doctors and patients, thus helping to improve the satisfaction of nurses.^{15,16} The satisfaction of surgeons to nurses in the experimental group and the control group was 90.00% and 60.00%, respectively. Surgeons' satisfaction with nurses in the experimental group was higher than that in the control group ($P < .05$), which reflected that standardized management, nursing team construction, and training in the hybrid operating room can improve the satisfaction of surgeons. This is because according to the clinical nursing-related work needs, nursing managers formulate the corresponding job responsibilities of each position, summarize, and improve the operation cooperation and management, carry out the integration and standardized management of the hybrid operating room, generate pictures and texts in the layout of the operating room, and achieve one-to-one correspondence with the operation needs. The active establishment of nursing teams and management procedures and standards for valuables can ensure the effective operation of hybrid operating rooms and improve the satisfaction of surgeons.¹⁷

SUMMARY

To carry out standardized management and nursing team construction and training in hybrid operating rooms is to strengthen relevant team construction, nursing management, and training education in hybrid operating rooms, combined with the research results to determine the specific layout of hybrid operating rooms and the positioning map of medical equipment related to various specialized operations. Determine the hand washing, the responsibilities of circuit nurses and nursing managers, and the management process and standards of valuable objects, determine the surgical training methods in the compound operating room, and standardize the nursing management to make the operation cooperation tend to be processed, shorten the preoperative preparation time of patients, relieve their pain, bring them high-quality nursing services, and improve the quality of nursing.¹⁸ At the same time, the implementation of standardized management and nursing team construction and training in hybrid operating

rooms is ideal, which can improve the theoretical knowledge and practical operation ability of nurses, improve the satisfaction of nurses and surgeons, and provide higher quality nursing services for patients, which is worthy of adoption. However, there are still some deficiencies in this article, such as the small number of samples included, the lack of continuous follow-up of the long-term effect of training, and the lack of analysis of the surgical indicators of patients, and the results are still not comprehensive enough. These need to be supplemented and improved in future studies to further demonstrate the above conclusions and guide clinical practice.

CONFLICT OF INTEREST

The authors have no potential conflicts of interest to report relevant to this article.

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AUTHOR CONTRIBUTIONS

JS and XZ contributed equally to this work; JS, XZ, and YJ designed the study and performed the experiments, YX and DH collected the data, HH and YY analyzed the data, and JS, XZ, and YJ prepared the manuscript. All authors read and approved the final manuscript.

ETHICAL COMPLIANCE

This study was approved by the ethics committee of the First Affiliated Hospital of Nanchang University. Signed written informed consent was obtained from the patients and/or guardians.

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