Original Article

The application value of orthopedics' operating room nursing model based on evidence-based nursing and PDCA circulation during the COVID-19 outbreak

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Abstract

Background: The Coronavirus pandemic has resulted in an extreme challenge for humanity in recent times, like the challenges faced during World War II. Its origin has been pointed out, and the speculation made on its source directly points towards Wuhan in China. Since then, it has spread across the globe. The pandemic has resulted in more than one million deaths, which is a considerable challenge for humanity.

Objective: With the pandemic of COVID-19, prevention of patient infection is crucial. This research focused on the orthopedic operating room nursing model effect based on evidence-based nursing and PDCA (Plan-Do-Check-act) cycle during the COVID-19 outbreak.

Materials and Methods: From February 2020 to May 2020, 146 patients were admitted and received orthopedic surgery at Xuanwu Chunshu Hospital, Beijing, China, these admissions were grouped into control and intervention groups, which was based on the treatment provided. Satisfaction, time to bed and hospitalization, postoperative incision infection, and the occurrence of deep venous thrombosis of lower extremities, pain degree score, surgical treatment effect, anxiety, and depression scores were compared for all the admissions between the control and intervention groups.

Results: In the control group, nursing satisfaction was less than in the intervention group. The time of getting out of bed and hospitalization was less in the intervention group; The total incidence of postoperative incision infection and lower limb deep vein thrombosis in the intervention group decreased. In the first postoperative day, the pain level in the intervention group was less than the control group. The effectiveness rate in the observation group is higher than that of the control group. Anxiety and depression scores of both groups tended to decrease with time and there was an interactive effect between grouping and time, where these differences were found to be statistically significant (P-value<0.05).

Conclusion: The clinical application of the orthopedics operating room nursing model based on evidence-based nursing and PDCA cycle is remarkable and worth implementing during the COVID-19 outbreak. [*Ethiop. J. Health Dev.*2021: 35(4):328-334]

Keywords: Evidence-based nursing; PDCA cycle; Establishment; Orthopedics; COVID-19; Operating room; Application value.

Introduction

The global pandemic of COVID-19 has had a significant impact on the global medical system. Medical Operations are often used to treat orthopaedic diseases, so the orthopaedics department has relatively more functions. There is a certain degree of risk in orthopaedic surgery regardless of the type or size, and due to the trauma, wide exposure range, and time taken to perform of orthopaedic surgery, surgeons and patients alike are at risk for developing COVID-19. This can cause psychological pressure, incision infection, lower extremity deep vein thrombosis, pain aggravation, and so on. Therefore, an adequate surgical nursing plan plays a vital role in orthopaedic surgery's

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curative effect and patient prognosis (1). Evidence-based nursing, also known as "empirical nursing", is a nursing method based on scientific research results with high credibility and value to avoid factors that reduce the prognosis effect and adverse events during the implementation of nursing intervention, to improve the nursing efficiency therapeutic effect (2,3). PDCA cycle (Plan Do Check Act Cycle), also known as the "deming cycle", was proposed by the famous American quality management expert William Edward Deming. It is a continuous improvement cycle system of nursing quality composed of four contents: Plan, Do, Check, and Action. It is characterized by standardized, scientific, and procedural nursing (4,5). There are few reports on applying evidence-based nursing combined with PDCA cycle nursing in the orthopaedic operating room. Therefore, this study discusses the nursing model application effect, on the orthopaedic operating room, based on evidence-based nursing and PDCA cycle and provides references for orthopaedic nursing staff to develop nursing plans in orthopaedic operating rooms. The report is as follows.

Materials and Methods
General data
About 146 orthopaedic surgery patients admitted to Xuanwu Chunshu Hospital, Beijing, China from February 2020 to May 2020 were selected as research participants. Inclusion criteria for patients' selections include: (1) first time orthopaedic surgery treatment; (2) No contraindications for orthopaedic surgery [6]; (3) and informed consent provided. Exclusion criteria were: (1) those with liver, heart, kidney, and other organic diseases; (2) those with mental conditions, autoimmune diseases, coagulation disorders, etc.; (3) those with cognitive functions or speech and communication disorders. Using the number table method, among the 146 patients, 73 patients were included in the control group, and the other 73 patients were included in the intervention group. Accordingly, the control group consisted of 34 males and 39 females. Their ages ranged from 18 to 71 years, with an average of (45.57±4.14) years old. The disease duration persisted for up to 27 days, in a standard (12.98±2.04) day. Total hip replacement cases were 14, while internal fixation and reduction cases were 18. A total of 20 cases were of upper limb surgery, and 21 lower limb surgery cases.

There were 9 cases with hypertension and 11 cases with diabetes. T the intervention group consisted of 42 female patients, and 31 male patients with a mean age of 46.13±3.56 years. Disease duration was up to 26 days, with a mean of (13.02±1.84) days. There were 14 cases of hip replacement, 13 cases of reduction and internal fixation, 22 upper limb surgery cases, and 24 lower limb surgery cases. There were 11 cases with hypertension and 12 cases with diabetes. The differences between the observation and control groups were the surgery types, disease course, gender, and age (P > 0.05).

Methods
Evidence-based nursing intervention
Specific methods of evidence-based nursing in the control group: (1) Before the commencement of orthopedic surgery, the nursing staff made a detailed assessment of the patient's primary condition, the scheduled procedures, and details of the surgery, and then integrated the assessment results according to the three, and then raised the relevant nursing problems. (2) Nursing staff checked data, such as related successful nursing experience cases, combined with the experience of clinical nursing staffs' personal skills and the actual situation of patients, the best care for patients with plan processing to develop the best nursing plan for patients. Furthermore, an evidence-based approach is also adopted in the comprehensive, cohesive treatment of patients' orthopaedic operation so that evidence-based nursing can be reflected in the nursing details and cohesion. (3) According to all the nursing points of patients, the nursing staff made targeted programs, especially paying close attention to patients' psychological changes, and providing psychological guidance when patients displayed negative emotions to cooperate with the treatment actively.

The intervention group implemented PDCA cycle nursing based on the control group (7). PDCA circulation nursing plan specific methods:

Plan
A) PDCA quality management team was set up at a meeting and clinical records of the common orthopedic surgery in the treatment of patients were analyzed. The causes of orthopedic disease, the location of the disease and the treatment of the patient was identified. Based

on the above information, targeted measures were timely formulated, and prevention and treatment plans were formulated, the methods and objectives of prevention and treatment management were clarified.

B) The nursing staff attended the relevant skill training, and the head nurse supervised and checked the implementation of each nursing staff.

Implementation: according to the prevention and control plan formulated above, the nursing staff improved the deficiencies in previous routine nursing work. The senior nurses explained and demonstrated the details of nursing operation and ensured that each nursing staff had sufficient knowledge of nursing operations before the implementation of the plan. The head nurse was responsible for the inspection and supervision of the implementation of various nursing operations of the nursing staff.

Examination: inspects the implementation of various nursing operations of the nurses. The basis of the examination was to ensure that the nurses carried out the nursing operations in strict accordance with the prevention and control management plan. The head nurse also carried out the nursing in a timely manner, recorded in detail the nursing process of the nurses and the matters noted in the nursing process, and organized the assessment.

Treatment: In each working day, guidance education was strengthened according to the actual situation of the nursing staff. The content of the guidance education mainly included the improper nursing practice and the weak nursing awareness. Head nurses analyzed the deficiencies in the process of nursing practice in a timely manner daily, undertook corresponding plans for improvement, constantly optimized the nursing operation plan; and supervised and urged the operating room to propose the rectification opinion and carry out the rectification.

Observation indicators

Nursing Satisfaction Score: using the questionnaire survey including dissatisfaction, general satisfaction and very satisfied. Satisfaction = (very satisfaction + basic satisfaction) cases/total cases ×100% [8]. (2) The

time out of bed and length of stay were recorded. (3) the incidence of postoperative incision infection and lower limb deep vein thrombosis was counted. (4) pain rating: visual analogue scale (VAS) was used for assessment on admission, and the first day after surgery (9). (5) surgical treatment effect: the success rate and effect of the operation were evaluated including ineffective, effective and recovery; Ratings for treatment effect were as follows; Ineffective: after treatment, the disease still exists, the pain symptoms are aggravated, accompanied by local infection; Effective: after treatment, the disease, pain and symptoms has less incidence; Recovery: after treatment, the disease was effectively controlled, and the recovery was good, with no serious complications. Total effective rate = (effective + cured) cases/total cases ×100% (10). (6) The scores of anxieties and depression were evaluated at three-time points: the day of hospitalization, 2 hours before the operation, and the first day after the operation. The anxiety score was evaluated using the self-rating Anxiety Scale (SAS), and the depression score was evaluated using the self-rating Depression Scale (SDS). The two scales included 20 items, each of which scored 1-4 points, with a score of 20; 20-80 points; 50-59 points for mild, 0-69 points for moderate, and more than 70 points for severe (11,12).

Statistical method

For data analysis, SPSS 25.0 statistical software was used. The qualitative data are shown in the inn (%), and χ^2 test was used, when $1 \leq$ theoretical frequency < 5. χ^2 value needs to be adjusted when the theoretical frequency < 1. It is calculated by the exact probability method; quantitative data is expressed by " $\bar{x}\pm$ s". T-test has been used to compare two groups, and ANOVA was used to compare data at different time points among the two groups. A p-value less than 0.05 was regarded as statistically significant.

Results

Comparison of satisfaction between the two groups

In the control group, the nursing satisfaction was 94.52% which was higher than the intervention group (76.71%); this difference is statistically significant (P<0.05, Table1).

Table 1: **Comparison of satisfaction between the two groups [n (%)]**

Group	Case	Dissatisfaction	Satisfaction	Very Satisfaction	Satisfaction rate
Intervention	73	17（23.29）	11（15.07）	45（61.64）	56（76.71）
Control	73	4（5.48）	17（23.29）	52（71.23）	69（94.52）
χ2					8.009
P					0.005

Comparison of time of getting out of bed and length of stay: In the intervention group, the time of getting out of bed was 1.45±0.21 (Table 2), which is significantly lower than the control group (P<0.05).

Table 2. **Comparison of hospitalization time and time out of bed between the two groups (d, x̄±s)**

Group	Case	Time out of bed in days	hospitalization
Control	73	2.19±0.43	8.42±2.11
Intervention	73	1.45±0.21	5.29±1.30
t		13.210	10.790
p value		＜0.001	＜0.001

Comparison of postoperative incision infection and incidence of lower limb deep vein thrombosis between the two groups: Lower limb deep vein thrombosis in the control group was 13.7 % which is significantly higher (P<0.05) than the observation group (5.48 %) (Table 3). The incision infection rate was also significantly higher in the control group than in the observation group.

Table 3: **Comparison of postoperative incision infection and incidence of lower limb deep vein thrombosis between the two groups [n (%)]**

Group	Case	Incision infection	Lower limb deep vein thrombosis	Total case
Control	73	8（10.96）	10（13.70）	18（24.66）
Intervention	73	1（1.37）	4（5.48）	5（6.85）
χ2				8.722
P				0.003

Comparison of pain degree scores between the two groups: In the control group, the pain degree after first-day surgery was 8.52±1.29 (Table 4), which is significantly higher (P<0.05) than the intervention group patients (6.83±1.08).

Table 4: **Comparison of pain scores between the two groups (score, x̄±s)**

Group	Case	Admission day	The first day after surgery
Control	73	5.81±0.52	8.52±1.29
Intervention	73	5.77±0.48	6.83±1.08
t		0.483	8.583
P		0.630	＜0.001

Comparison of surgical treatment effect between the two groups: In the control group, the patients total effective rate of the surgery (100%) was significantly higher (P < 0.05) than the control group patients (94.52%), as shown in table 5.

Table 5: **Comparison of surgical treatment effect between two groups [n (%)]**

Group	Case	Ineffective	Effective	Recovery	Total effective
Control	73	4 （5.48）	9 （12.33）	60 （82.19）	69 （94.52）
Intervention	73	0 （0）	4 （5.48）	69 （94.52）	73 （100.0）
χ2					5.658
P					0.017

Comparison of anxiety scores between the two groups:
The anxiety scores of the intervention group were lower than those of the control group (intergroup effect: F=29.050, P < 0.001) (Figure 1), the anxiety scores of both groups showed a trend of decreasing with time (time effect: F=13.52, P < 0.001), and the groups had an interaction effect with time (interaction effect: F=6.861, P=0.001).
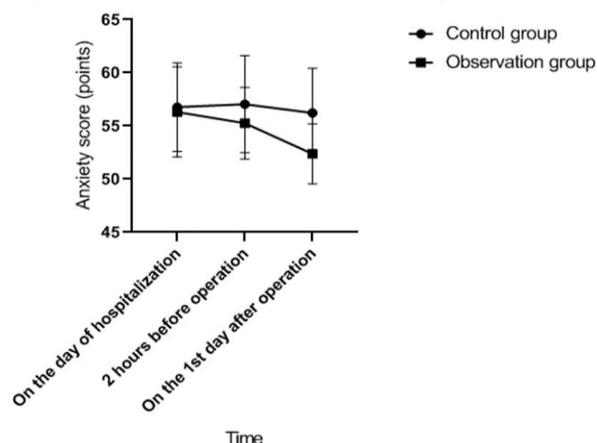

Figure 1: **Comparison of anxiety scores between the two groups**

The depression scores of the intervention group were lower than those of the control group (intergroup effect: F=26.620, P < 0.001), the depression scores of both groups showed a trend of decreasing with time (time effect: F=10.88, P < 0.001) (Figure 2), and the groups had an interaction effect with time (interaction effect: F=8.591, P < 0.001).

Discussion
PDCA is scientific and practical quality control, and a management method which has been widely recognized. At present, the PDCA cycle method has been applied to management in multiple fields and achieved good results. It impeccably connects through four steps, including planning, implementation, inspection, and treatment, and continuously optimizes management in continuous circulation (13).

This study revealed that in the intervention group, nursing satisfaction was significantly higher (94.52%) than the control group patients (76.17%). In the intervention group, the time of getting out from bed and stay-length was much less than the control group, the degree of pain and the total incidence of postoperative incision infection and lower limb deep vein thrombosis was much lower in the observation group than the control group. In the intervention group total effective rate of surgical treatment was (100.0%) higher, but the anxiety score (intergroup effect: F=29.050, P < 0.001) and depression score (intergroup effect: F=26.620, P < 0.001) was much less than for the control group patients. However, the anxiety score indicated a decreasing trend with time (time effect: F=13.52, P < 0.001).

The depression score of both groups showed a trend of decreasing with time (intergroup effect: F=10.88, P < 0.001). The above differences were statistically significant (P < 0.05). This indicates that compared with the simple implementation of evidence-based nursing, based on evidence-based nursing and the establishment of the PDCA cycle, the orthopaedic

surgery nursing mode can improve the orthopaedic surgery patients' satisfaction, their total effective rate of the operation, shorten bedtime and length of hospital stay, reduce the postoperative incision infection, and overall lower the limb profound vein thrombosis incidence, degree of pain and depression and anxiety score, which indicates a remarkable application effect. The following are four possible reasons for these positive changes. The first reason could be that nurses adopted the evidence-based nursing method, followed the evidence and integrated reliable scientific evidence into nursing practice to provide evidence-based support for PDCA nursing work. On this basis, nurses adopted the PDCA circular nursing method through the repeated implementation of the four stages of planning, implementation, inspection, and treatment. By continuously finding out the problems in the process of nursing services and taking corresponding measures to solve the problems, the nursing staff timeously formulated new nursing implementation plans from PDCA circulation steps, and continuously improved the management and quality of nursing in the orthopaedic operating room, so that the patients were more satisfied with the nursing service (14-16). The second reason could be since orthopaedic operating room adopted the PDCA cycle model to institutionalize and standardize the nursing operation, by optimizing the level and quality of orthopaedic nursing, to promote patients' recovery, and shorten the time for patients to get out of bed and their stay in hospital (17). The third explanation owes to the implementation of the PDCA cycle can strengthen the control of all aspects of nursing, including making plans, implementation, follow-up inspection and rectification, systematic management of nursing quality, provide favorable conditions for the smooth operation and reduction of the occurrence of adverse events such as incision infection and deep vein thrombosis of lower limbs (18). Finally, the PDCA cycle is a process of continuous improvement of quality. In nursing, patients' fear and anxiety for surgery should be prioritized and appropriate counselling programs should be developed to help patients eliminate anxiety and depression to keep patients stable and to promote recovery (19, 20).

Conclusion

Even though, the findings may be biased due to the small sample size, research with a larger sample size can be undertaken to confirm the findings and ensure generalizability, overall, the orthopaedic operating room nursing model's clinical application effect based on evidence-based nursing and PDCA cycle is significant and worth carrying out.

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