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ARTICLE

Construction and Application Effect Analysis of Orthopedic Pain Care Ward under Multi-Disciplinary Cooperation Model

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Abstract

Aims/Background A multidisciplinary team (MDT) approach is a nurse-led pain management method that involves collaboration with staff from other departments. The purpose of this paper was to discuss the construction and application effect of a pain care ward in orthopedics utilizing the MDT approach.

Methods A retrospective analysis of case data was conducted, selecting 90 patients with hip joint fractures who underwent hip replacement arthroplasty (HRA) at our hospital between February 2021 and February 2024. The patients were divided into two groups based on the nursing methods: a control group (n = 43), which received a conventional analgesic management program, and an intervention group (n = 47), which received the same conventional analgesic management program along with the implementation of an orthopedic pain care ward under the MDT approach. The study compared the pain knowledge and attitudes of the responsible nurses in both groups through questionnaires. Additionally, the accuracy of pain assessments and the awareness rates of patients' pain-related health education were evaluated and compared between the two groups. Furthermore, the effectiveness of pain intervention, range of motion (ROM), and Hospital for Special Surgery (HSS) scores before and after the intervention were analyzed. The incidence of complications and overall nursing satisfaction were also compared between the two groups.

Results The general knowledge, pain assessment, drug analgesia, comprehensive application, and total scores of nurses in the intervention group were significantly higher than those in the control group ($p < 0.05$). The accuracy rate of nurses' pain assessments and the awareness rate of patients' pain health education in the intervention group were 91.49% and 93.62%, respectively, both significantly higher than the 72.09% and 79.07% observed in the control group ($p < 0.05$). The total effective rate of pain intervention in the intervention group was 74.47%, significantly higher than the 53.49% in the control group ($p < 0.05$). After the intervention, both the ROM and HSS scores in the intervention group were significantly higher than those in the control group ($p < 0.05$). The overall incidence of complications in the intervention group was 6.38%, significantly lower than the 20.93% in the control group ($p < 0.05$). Finally, the total satisfaction rate with nursing care in the intervention group was 91.49%, significantly higher than the 74.42% in the control group ($p < 0.05$).

Conclusion The construction and application of an MDT pain care ward can effectively enhance the accuracy of nurses' pain assessments, increase patients' awareness of pain-related health education, and improve the efficiency of pain interventions. Additionally, it can lead to better joint mobility and improved hip function, promoting the sustainable development of the pain care ward. These improvements contribute to higher patient satisfaction and enrich the quality of nursing services.

Key words: multi-disciplinary team; department of orthopedics; pain care ward; construction; effect

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Introduction

Pain is a distressing experience associated with actual or potential tissue damage and is recognized as the fifth vital sign, particularly as the primary symptom among orthopedic patients (Chunduri and Aggarwal, 2022; Neuman et al, 2022). Preoperative trauma, the surgical process, postoperative fixation, and functional exercises all bring to varying degrees of pain and discomfort. Prolonged pain stimulation can induce a range of physiological, pathological, and psychological changes in patients, leading to metabolic endocrine dysfunction, reduced sleep quality, and potentially hindering subsequent rehabilitation and exercise. This, in turn, can impair functional recovery and increase the risk of complications (Dahshan et al, 2022; Mariano et al, 2022). Therefore, reducing patients' pain and enhancing their comfort has become a critical focus of clinical research.

Conventional analgesic methods, such as analgesic pumps and painkillers, are commonly used in clinical settings and have significantly improved pain management outcomes. However, over 50% of patients still experience pain that remains unrelieved (Hansen et al, 2023; Heath et al, 2022). The multidisciplinary team (MDT) approach is a nurse-led, multidisciplinary pain management model that involves collaboration with staff from various departments to establish a dedicated pain care ward. This model facilitates more standardized and professional pain management, potentially enhancing the effectiveness of analgesic interventions (Staudt, 2022; Venturin et al, 2024).

This study retrospectively analyzed case data and selected 90 patients who underwent hip replacement arthroplasty (HRA) at our hospital between February 2021 and February 2024. The objective was to establish an orthopedic pain care ward under the MDT model and to evaluate its effectiveness.

Methods

General Information

A retrospective analysis was conducted on the case data of 90 patients with hip joint fractures who underwent HRA at our hospital between February 2021 and February 2024. The inclusion criteria were as follows: (1) all patients with hip joint fractures were hospitalized for the first time; (2) complete clinical data were available with no loss; and (3) patients were aged between 18 and 80 years. The exclusion criteria included: (1) the presence of pathological fractures; (2) complications involving nervous system or mental illness; (3) allergies or sensitivities to the drugs used in this study; and (4) severe dysfunction of vital organs.

Based on the nursing methods, the patients were divided into two groups: a control group (routine nursing, n = 43) and an intervention group (routine nursing plus the establishment of an orthopedic pain care ward under the MDT model, n = 47). This study was approved by the Xiangtan Central Hospital Medical Ethics Commission (No. 2023-KC-3), and informed consent was obtained and signed by the patients or their family members throughout the experiment. The study was conducted in accordance with the Declaration of Helsinki.

Nursing Methods

The control group received the routine analgesic management program, which included preoperative routine health education and admission assessment provided by the responsible nurse. This education informed the patient about the surgical process and necessary precautions. Postoperatively, the patient's blood transport status in the affected limb was monitored, along with routine electrocardiogram (ECG) monitoring, drainage tube care, dietary guidance, and functional exercise. Pain management involved the use of a self-controlled analgesic pump and drug painkillers as prescribed by the doctor. The analgesic pump was removed 48 hours after surgery, and symptomatic treatment was administered according to the patient's condition.

In the intervention group, an orthopedic pain care ward under the MDT model was established in addition to the routine care provided to the control group. The nurse-led multidisciplinary cooperative pain management model was implemented as follows:

(1) Establishing an Effective Pain Management Team: An MDT team was formed, comprising head nurses, pain navigation nurses, anesthesiologists, doctors, rehabilitators, and pharmacists. The team was led by pain navigation nurses, with support from the other disciplines.

(2) MDT Team Professional Knowledge Training: A structured training plan was developed, consisting of stepwise training for all staff. The first phase of training targeted core project team members, while the second phase focused on medical staff in the ward. Training methods included expert lectures, case discussions, and case management. The first phase involved staying updated on the latest developments in pain management both domestically and internationally, and participating in relevant training courses to gain best practices. The second phase was tailored to align with the learning content and clinical needs of the ward.

(3) Establishing a Standardized Management Process: A pain pathway checklist was created to outline the steps from admission to discharge, detailing the specific pain care actions required at each time point. In clinical practice, care plans were developed and implemented according to this pathway, with patient participation in the supervision and management of their pain care plan based on their individual needs. This approach aimed to facilitate hierarchical and rational pain management, minimize errors due to differences in nurse practices, and ensure timely and effective pain relief for patients. The standardized process also enhanced the operability of pain management and encouraged patients to understand and engage with their own pain care plan goals, thereby improving cooperation.

(4) Standardizing Quality Evaluation and Control: A "Pain Care Quality Inspection Form" and "Patient Pain Management Satisfaction Questionnaire" were designed for quality control and evaluation. A Quality Circle (QC) group was established to manage continuous improvement through the Plan-Do-Check-Act (PDCA) cycle.

Observation Indicator

Questionnaire on Pain Knowledge and Attitude of Nurses

The Pain Knowledge and Attitude Questionnaire for orthopedic nurses, designed by American pain expert Betty Ferrell, was used in this study. This questionnaire was developed in accordance with the pain management standards established by the American Pain Society (APS), the World Health Organization, and the American Health Care Institute (Ferrell et al, 1993), and has been effectively applied in various countries. The scale consists of 40 items, including 22 true or false questions, 14 multiple-choice questions, and 2 case analysis questions. Specifically, questions 37 and 38 are case analysis questions, with each case analysis consisting of two parts (37A, 37B, 38A, 38B).

The questionnaire covers four main areas: general knowledge of pain, pain assessment, principles of pain medication, and comprehensive application. Scoring is strictly based on the standard answers, with each question valued at 1 point, resulting in a maximum possible score of 40 points. Incorrect or unanswered questions are scored as 0 points.

The scale has been validated for use in China (Xiong and Feng, 2016) and has demonstrated good feasibility. The original scale's test-retest reliability coefficient is above 0.80, and the internal consistency reliability coefficient exceeds 0.70. For the Chinese version of the scale, the total content validity index and Cronbach's alpha coefficient are 0.96 and 0.73, respectively.

Accurate Pain Assessment and Pain Health Education Awareness Evaluation

On-site inspections were conducted twice a week for a total of 4 weeks. During each inspection, at least 5 responsible nurses were randomly selected and evaluated by a quality inspector. The evaluation focused on whether the nurses' pain assessment was comprehensive, whether the assessment method was correct, and whether the results were consistent with those of the quality inspector.

Additionally, the awareness rate of health education was assessed by interviewing patients and their families. Both the nurses and patients in the two groups were evaluated, and the accuracy rate of pain assessment, as well as the awareness rate of patients regarding pain health education, were recorded and compared between the two groups.

Evaluation of Pain Intervention Effect

The treatment improvement rate was assessed using the Japanese Orthopaedic Association Scores (JOA) (Amako et al, 2022). A significant improvement was defined as a Visual Analogue Scale (VAS) score improvement rate of >60% after intervention. Improvement rates between 25%–60% were considered effective, while rates <25% were deemed ineffective. Total effectiveness = significant effect + effective.

Hip Joint Function

Hip joint function was evaluated using the Range of Motion (ROM) and the Hospital for Special Surgery (HSS) score (Bori et al, 2023). ROM was measured

using a ruler, with each measurement taken three times and averaged. The HSS score encompasses 7 dimensions, with a maximum total score of 100 points. Higher scores indicate better hip function.

Evaluation of Complications

Complications such as lung infection, deep venous thrombosis (DVT), and urinary system infection were observed and recorded for all patients in both groups. The total incidence of complications was compared between the two groups.

Nursing Satisfaction

Nursing service satisfaction was evaluated using the Newcastle Satisfaction with Nursing Scale (NSNS) (Thomas et al, 1996), which employs a Likert 5-point scale. Evaluation indicators included nurses' service attitude and attention to patients. The questionnaire was completed by patients upon discharge and covered four dimensions: health education, nurse operation, analgesic nursing, and service attitude, with a total of 25 items. The maximum score was 100, with $\geq$90 indicating very satisfied, 80–89 indicating relatively satisfied, and $<$80 indicating dissatisfied.

Statistical Methods

SPSS 20.0 software (IBM, Armonk, NY, USA) was used to analyze the experimental data. The measurement data, such as age, HSS score and ROM, were represented by ($\bar{x} \pm$ s), which were in accordance with normal distribution, and independent sample t-test was adopted. Gender, pain intervention effect, satisfaction and other statistical data were represented by (%), χ^2 test was used for comparison between groups. The results were considered statistically significant with $p < 0.05$.

Results

Comparison of Baseline Characteristics

There were no significant differences in age, gender and body mass index (BMI) between the two groups ($p > 0.05$). See Table 1.

Comparison of Pain Knowledge and Attitude Scores of Nurses between the Two Groups

The general knowledge, pain assessment, drug analgesia, comprehensive application, and total scores of nurses in the intervention group were significantly higher than those in the control group, with statistical significance ($p < 0.05$). See Table 2.

Comparison of the Accuracy Rate of Nurses' Pain Assessment and Patients' Awareness Rate of Pain Health Education between the Two Groups

The accuracy rate of nurses' pain assessment and the awareness rate of patients' pain health education in the intervention group were 91.49% and 93.62%, respectively. These rates were significantly higher than the 72.09% and 79.07% observed in the control group, with statistical significance ($p < 0.05$). See Table 3.

Table 1. General data analysis of the two groups [n (%, $\bar{x} \pm s$)].

Grouping	n	Age (Years)	Gender		BMI (kg/m^2)
			Male	Female	
Control group	43	45.12 ± 8.15	26 (60.47)	17 (39.53)	22.18 ± 6.16
Intervention group	47	44.96 ± 7.24	28 (59.57)	19 (40.43)	22.30 ± 4.01
χ^2/t		0.099	0.007		0.110
p		0.922	0.931		0.912

Note: BMI, body mass index.

Table 2. Comparison of pain knowledge and attitude scores of nurses between the two groups ($\bar{x} \pm s$).

Index	Control group (n = 43)	Intervention group (n = 47)	t	p
General knowledge	5.86 ± 1.36	8.86 ± 2.42	7.158	<0.001
Pain assessment	1.28 ± 0.45	1.89 ± 0.31	7.542	<0.001
Medicated analgesia	6.09 ± 2.06	15.28 ± 4.72	11.778	<0.001
Comprehensive application	0.93 ± 0.26	3.21 ± 1.06	13.726	<0.001
Total score	13.58 ± 2.65	29.23 ± 5.81	16.184	<0.001

Table 3. Comparison of nurses' pain assessment accuracy rate and patients' awareness rate of pain health education between the two groups [n (%)].

Grouping	n	Accurate pain assessment		Patient pain and health education awareness	
		Accurate	Inaccurate	Known	Unknown
Control group	43	31 (72.09)	12 (27.91)	34 (79.07)	9 (20.93)
Intervention group	47	43 (91.49)	4 (8.51)	44 (93.62)	3 (6.38)
χ^2		5.780		4.112	
p		0.016		0.043	

Table 4. Comparison of pain intervention effect between the two groups [n (%)].

Grouping	n	Significant effect	Effective	Invalid	Total effective
Control group	43	10 (23.26)	13 (30.23)	20 (46.51)	23 (53.49)
Intervention group	47	15 (31.91)	20 (42.56)	12 (25.53)	35 (74.47)
χ^2					4.314
p					0.038

Comparison of Pain Intervention Effects between the Two Groups

The total effective rate of pain intervention in the intervention group was 74.47%, which was significantly higher than that in the control group (53.49%), and the difference was statistically significant ($p < 0.05$). See Table 4.

Table 5. Comparison of joint motion and function between the two groups ($\bar{x} \pm s$).

Grouping	n	ROM (°)			HSS score (points)		
		Before intervention	After intervention	The difference before and after intervention	Before intervention	After intervention	The difference before and after intervention
Control group	43	83.47 ± 15.13	100.14 ± 21.28^{b}	16.54 ± 3.48	51.42 ± 15.03	57.95 ± 10.03^{b}	6.24 ± 1.57
Intervention group	47	84.02 ± 11.27	113.32 ± 22.18^{ab}	29.76 ± 6.85	50.96 ± 16.25	64.66 ± 13.93^{ab}	15.49 ± 2.94
t		0.197	2.871	11.379	0.139	2.601	18.368
p		0.845	0.005	<0.001	0.889	0.011	<0.001

Note: Compared with the control group, $^{a}p < 0.05$; Compared with the same group before intervention, $^{b}p < 0.05$.
ROM, range of motion; HSS, Hospital for Special Surgery.

Table 6. Comparison of complications between the two groups [n (%)].

Grouping	n	Pulmonary infection	DVT	Urinary tract infection	Total occurrence
Control group	43	3 (6.98)	2 (4.65)	4 (9.30)	9 (20.93)
Intervention group	47	1 (2.13)	0 (0.00)	2 (4.26)	3 (6.38)
χ^2					4.112
p					0.043

Note: DVT, deep venous thrombosis.

Table 7. Comparison of nursing satisfaction between the two groups [n (%)].

Grouping	n	Very satisfied	Relatively satisfied	Not satisfied	Overall satisfaction
Control group	43	12 (27.91)	20 (46.51)	11 (25.58)	32 (74.42)
Intervention group	47	19 (40.43)	24 (51.06)	4 (8.51)	43 (91.49)
χ^2					4.712
p					0.030

Comparison of Joint Motion and Function between the Two Groups

Before the intervention, there was no significant difference in ROM and HSS scores between the two groups ($p > 0.05$). After the intervention, the ROM and HSS scores in the intervention group were significantly higher than those in the control group, with statistical significance ($p < 0.05$). The difference in ROM and HSS scores before and after treatment between the two groups was also statistically significant ($p < 0.05$). See Table 5.

Comparison of Complications between the Two Groups

The total incidence of complications in the intervention group was 6.38%, significantly lower than that in the control group (20.93%), and the difference was statistically significant ($p < 0.05$). See Table 6.

Comparison of Nursing Satisfaction between the Two Groups

The total satisfaction rate of nursing in the intervention group was 91.49%, which was significantly higher than that in the control group (74.42%), and the difference was statistically significant ($p < 0.05$). See Table 7.

Discussion

Pain is the most critical and primary symptom experienced by orthopedic patients. With the adoption of rapid rehabilitation concepts in orthopedics, clinical demands for effective perioperative analgesia have increased (Ashar et al, 2022; Patiyal et al, 2021). Studies have indicated that a lack of a comprehensive pain management system and standardized management processes is a primary contributing factor (Arkin et al, 2022; Whalen et al, 2021). Consequently, medical institutions face the significant challenge of developing effective pain care models to enhance postoperative rehabilitation and patient comfort.

MDT is a management approach introduced by American scholar Wagner in the 1990s. It involves the collaboration of disease-related departments to offer patients comprehensive, systematic, and professional nursing services, thereby enhancing the quality of clinical care. Initially, MDT was primarily applied to chronic conditions such as heart disease (Hendriks and Jaarsma, 2021). However, recent research has demonstrated that MDT can be effective in perioperative analgesia, improving pain management outcomes. For example, Hérion et al (2023) found that incorporating short-term mechanical circulatory support devices into a multidisciplinary shock team for patients with refractory cardiogenic shock can significantly increase 1-year survival rates.

In recent years, the application of MDT has increasingly extended to perioperative analgesia. Many developed countries and regions have transitioned from traditional pain management models centered around anesthesiologists to MDT team-based approaches with pain specialist nurses at the core, yielding positive results (Nim et al, 2023; Tetlow et al, 2022).

In this study, the general knowledge, pain assessment, drug analgesia, comprehensive application, and total scores of nurses in the intervention group were significantly higher than those in the control group. Specifically, the accuracy of pain assessment in the intervention group was 91.49%, markedly higher than the 72.09% observed in the control group. This suggests that establishing an orthopedic pain care ward under MDT significantly enhances nurses' knowledge and clinical experience in pain management, improving the accuracy of pain assessments.

The implementation of path management within our department standardizes the pain management process, leveraging the extensive resources of a general hospital. In order to provide patients with more accurate and reasonable pain management interventions (Wang et al, 2023), a quality control and evaluation system has been established to identify and address quality issues in pain management, promote continuous improvement, reduce errors caused by variations among nurses, and enhance nursing capabilities with strong operational effectiveness (Goodall and Brown, 2022; Mei et al, 2022).

Currently, clinical pain management in our country primarily follows a nurse-led model, which typically adheres to conventional pain management pathways; however, this approach often lacks a comprehensive, objective, and proactive systematic pain management strategy for patients (Coccolini et al, 2022; Sabesan et al, 2023). MDT, by integrating multiple disciplines, offers a more systematic approach. It evaluates pain levels through a single-step process in strict adherence to pain management pathways, allowing for timely adjustments to analgesic plans based on changes in pain levels, and plays a crucial role in providing effective nursing interventions to alleviate pain (Nallani et al, 2021; Panicker et al, 2022).

In this study, the awareness rate of pain health education in the intervention group was 93.62%, significantly higher than the 79.07% observed in the control group. Additionally, the total effective rate of pain intervention in the intervention group was 74.47%, compared to 53.49% in the control group. These findings indicate that the MDT pain care ward effectively improves pain relief for orthopedic patients.

The MDT model involves the collaboration of multidisciplinary teams, including nurses, anesthesiologists, doctors, and pharmacists, with nurses leading the timely and accurate assessment of patients' pain and the formulation of precise analgesic strategies. The involvement of anesthesiologists, pharmacists and other specialists ensures a high level of professionalism and standardization in pain management, providing patients with efficient and effective care throughout the entire process (Bapat et al, 2023; Wally et al, 2022).

In addition, this study revealed that the ROM and HSS scores of patients in the intervention group were significantly higher than those in the control group after intervention. The total complication rate in the intervention group was 6.38%, significantly lower than the 20.93% observed in the control group. Furthermore, the total satisfaction rate with nursing services in the intervention group was 91.49%, compared to 74.42% in the control group. These results suggested that implementing an orthopedic pain care ward under the MDT model can significantly enhance hip joint function, align with rapid rehabilitation principles, and reduce the incidence of postoperative complications.

The MDT approach allows for comprehensive multi-disciplinary collaboration to manage and oversee patients' pain care plans effectively. This collaboration ensures optimal pain control, supports functional exercise and activities post-surgery, and contributes to quicker recovery of hip joints and improved quality of life for patients (Bronfort et al, 2022; Porzio et al, 2023). The establishment of the pain care ward has facilitated continuous education for medical staff, including pain management education, case reviews, and regular discussions to address complex pain control issues.

Moreover, patients under the MDT model gain a clearer understanding of their pain care objectives and become more actively involved in their rehabilitation process. This active participation fosters a collaborative environment between nurses and patients, improving self-management skills and enhancing patient satisfaction with nursing services. This model reflects a contemporary medical workers' pursuit of the perfect technical realm and their concern for humanity (Rathore et al, 2024).

Overall, the construction and application of an MDT pain nursing ward significantly improves the accuracy of pain assessment by nurses, enhances patient knowledge of pain management, increases the efficiency of pain interventions, and contributes to better joint function and overall patient satisfaction. It also supports the sustainable development of pain management practices in clinical settings.

This study analyzed the construction and application effects of a pain care ward in the orthopedic department using a multi-disciplinary cooperation model. Despite its valuable insights, it is important to note that this study was retrospective with a relatively small sample size. Future research should focus on conducting large-scale, multi-center randomized controlled trials to further validate and refine the MDT approach. Such studies would provide deeper insights into the long-term effects of the MDT model and explore its potential scalability to other medical departments.

The MDT model offers notable advantages, including enhanced patient satisfaction and a deeper integration of high-quality nursing services. It helps provide more precise and effective guidance for comprehensive care in orthopedic settings, contributing to improved pain management and overall patient outcomes.

Conclusion

In summary, the construction and application of an MDT pain care ward can significantly enhance various aspects of pain management in orthopedic settings. It improves the accuracy of nurses' pain assessments, increases patients' awareness of pain health education, and boosts the efficiency of pain interventions. Additionally, it positively impacts patients' joint motion and knee joint function, contributing to their overall recovery. This approach not only helps in enhancing patient satisfaction but also supports the sustainable development of pain care wards, thereby deepening the quality of nursing services.

Key Points

- The establishment and application of an orthopedic pain care ward under the MDT model significantly enhance the accuracy of nurses' pain assessments.
- The construction and application of MDT pain care ward improves patients' awareness of pain health education, increases the effectiveness of pain interventions, and enhances patients' joint motion.
- The MDT model supports the sustainable development of pain care wards, ensuring long-term efficacy and progress.
- Implementing the MDT pain care ward helps improve patient satisfaction and enriches the quality of nursing services.

Availability of Data and Materials

The datasets used and/or analysed during the current study were available from the corresponding author on reasonable request.

Author Contributions

TX and PTY designed the study, and all authors conducted the study. YYW and CZ collected and analyzed the data. TX and PTY participated in drafting the manuscript, and all authors contributed to critical revision of the manuscript for important intellectual content. All authors gave final approval of the version to be published. All authors participated fully in the work, took public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or completeness of any part of the work are appropriately investigated and resolved.

Ethics Approval and Consent to Participate

This study was approved by the Xiangtan Central Hospital Medical Ethics Commission (No. 2023-KC-3), and informed consent was obtained and signed by the patients or their family members throughout the experiment. The study was conducted in accordance with the Declaration of Helsinki.

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Conflict of Interest

The authors declare no conflict of interest.

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