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Original Article

Impact of the Interaction Model of Client Health Behavior on the Physical and Psychological Health of Patients with Limb Fracture

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Abstract

Background: During rehabilitation, patients with limb fracture should receive physical and psychological nursing. The study aimed to explore the intervention effect of the Interaction Model of Client Health Behavior on the physical and psychological health of patients with limb fracture.

Methods: Convenience sampling was used to recruit patients with limb fracture who underwent orthopedic treatment in three hospitals in Zhejiang Province, China from 2021-2022. In total, 118 volunteers were recruited and randomly divided into intervention (n = 60) and control (n = 58) group. The control group received routine treatment and nursing of limb fracture, whereas the intervention group received nursing intervention under the Interaction Model of Client Health Behavior. The Self-rating Depression Scale (SDS), Self-rating Anxiety Scale (SAS), Athens Insomnia Scale (AIS), and Visual Analogue Scale (VAS) were used to evaluate the effect of nursing intervention under the Interaction Model of Client Health Behavior.

Results: The intervention group had significantly lower SDS, SAS, AIS, and VAS scores than the control group ($P < 0.001$) and significantly higher differences before and after treatment than the control group ($P < 0.001$).

Conclusion: The Interaction Model of Client Health Behavior can effectively improve the physical and psychological health of patients with limb fracture.

Keywords: Models; Health; Behavior; Limb fracture; Pain psychological

Introduction

Limb fracture is a common clinical orthopedic disease (1). Patients with fracture must endure strong physical pain and quickly adapt to the new external environment. They are highly prone to psychological or psychological disorders, such as irritability and psychomotor excitement (2). Cheng et al. evaluated the psychological condition of hospitalized patients with lower limb fracture and found that more than 50% of them had obvious anxiety (3). Most patients with limb fracture are hospitalized due to emergencies, such as car accidents and falls, and are generally treated with surgery (4).

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Limb fracture often leads to unbearable pain in patients and their inability to take care of themselves, thus seriously affecting their quality of life (5). It may reduce the body immunity, cause postoperative infection, and undermine the repair of tissues, which are not conducive to fracture healing (6). Therefore, in addition to limb fracture surgical treatment, appropriate nursing intervention measures that can reduce the pain, alleviate the negative mood, and promote the rehabilitation of patients are also important. Traditional Chinese medicine nursing hot compress (7), comprehensive nursing intervention (8), psychological nursing intervention, pain nursing, and progressive muscle relaxation training of patients with limb fracture can significantly reduce their pain and strengthen the treatment effect (9). Health education can equip patients with disease-related knowledge and boost their self-management level. However, health education in traditional nursing still stays in the stage of knowledge indoctrination. Patients become passive information receivers short of active interaction and communication with health managers. Their low-level learning enthusiasm in this case leads to the poor effect of health education (10).

Cox's Interaction Model of Client Health Behavior (IMCHB) is a practical nursing model connecting nursing evaluation, nursing intervention, and nursing effect. It can systematically guide nursing research and advance the development and application of nursing intervention (11-12). This model expounds how health-related behavior is affected by the background factors, intrinsic motivation, cognitive evaluation, emotional response of the client and his/her interaction with health care professionals. It highlights the joint contribution of interactions among the client, family members, and health care professionals to the formation and promotion of health behavior. Cox argued that (13) intervention fitting the uniqueness of the client and interactive relationships can effectively yield health outcomes, and with the advancement of time, health outcomes reflect all variables that act on the uniqueness of the client.

The IMCHB is an interaction and feedback cycle composed of three parts: the characteristics of the client, paramedic–patient interaction, and health outcomes. Five aspects, including utilization rate of health care services, indicators of clinical health status, severity of health problems, treatment compliance, and service satisfaction, constitute the effect evaluation part of the model (14-16). Different from other nursing models, the IMCHB clearly describes the variable factors that paramedics need to evaluate before implementing nursing intervention and how to attain positive health outcomes through targeted paramedic–patient interaction. Therefore, the patient must take personal responsibility for health problems and make decisions on health promotion behavior (10).

At present, the IMCHB has been widely used in nursing research, covering 1) the exploration of the contribution of social impact and previous medical care experience to improving women's cognition of uterine biopsy and cervical cancer (17); 2) the identification of determinants that can be used to assess the nursing compliance of patients with AIDS (18). However, the elements of paramedic–patient interaction remain unknown. Only one study applied the IMCHB to guide postpartum discharge education (19). The IMCHB has universality in covering a full range of nursing practices but also has the particularity in role positioning and guiding paramedics to evaluate, diagnose, intervene in, and promote health outcomes (20). In this model, the patient is not treated as a unique individual in multiple aspects. In the nursing process, evaluating the patient in an all-round way and establishing a health-friendly therapeutic paramedic–patient relationship have a beneficial impact on health outcomes. China has gradually introduced and applied the IMCHB in nursing work (21). Nevertheless, relevant reports on the scheme of nursing patients with limb fracture under this model are unavailable. In response, the IMCHB was innovatively applied in this study to the nursing of patients with limb fracture, and the impact of this model on the depression, anxiety, pain, and sleep quality of patients with limb fracture was evaluated.

Materials and Methods

Convenience sampling was used to select patients randomly with limb fracture who accepted orthopedic treatment from 2021-2022 in three hospitals in Zhejiang Province, China, namely, the Affiliated Hospital of Hangzhou Normal University, the Second Affiliated Hospital of Zhejiang Chinese Medical University, and Hangzhou Red Cross Hospital.

Inclusion criteria: 1) those who met the diagnostic criteria of fracture by imaging examination; 2) those with clear consciousness and normal speaking, reading, and writing abilities; and 3) those who participated voluntarily in this study. Exclusion criteria: 1) those with unclear consciousness along with serious functional injury of other organs, blurred consciousness, psychological disorder, or impossibility to continue participation in the study due to death caused by other reasons after discharge and 2) those who were unwilling to accept intervention.

In total, 118 patients were finally included and randomly divided into intervention (n = 60) and control (n = 58) groups. This study met the requirements raised by the hospital ethics committee, and all the volunteers signed the informed consent.

Research tools

Self-rating Depression Scale (SDS): SDS was used to evaluate the depression state of each patient (22). The scale includes 20 items, scored from 1 to 4, corresponding to never, occasionally, often, and always. The total score of the scale is obtained by adding the score of each item. The standard score is calculated by multiplying the total score by 1.25. SDS scores <50, 50–59, 60–69, and 69> represent no, mild, moderate, and severe depression, respectively. In the present study, the Cronbach's α coefficients of this scale were 0.951 and 0.975 before and after the intervention, respectively. The intervention and control groups were simultaneously measured by this scale before and 7 days after the intervention to compare the effect.

Self-rating Anxiety Scale (SAS): SAS was used to measure the degree of anxiety (23). This scale includes 20 items, scored from 1 to 4, corresponding to never, occasionally, often, and always. The total score of the scale is obtained by adding the score of each item. The standard score is calculated by multiplying the total score by 1.25. SAS scores 50–59, 60–69, and 70> represent mild, moderate, and severe anxiety, respectively. In the present study, the Cronbach's α coefficients of this scale were 0.942 and 0.972 before and after the intervention, respectively. The intervention and control groups were simultaneously measured by this scale before and 7 days after the intervention to compare the effect.

Athens Insomnia Scale (AIS): Sleep quality was assessed using AIS (24), the scale contains eight self-rating items, including sleep latency, subjective sleep quality, hours of sleep, waking-up at night, waking-up earlier than expected, daytime emotion, daytime function, and daytime sleepiness. Each item is scored from 0 to 3, corresponding to no, mild, moderate, and severe. The total score ranges from 0 to 24. A higher score indicates worse sleep quality. In specific, AIS scores <4, 4–6, and 6> represent no sleep disorder, suspected insomnia, and insomnia, respectively (24). The Cronbach's α coefficients of this scale were 0.850 and 0.925 before and after the intervention, respectively. The intervention and control groups were simultaneously measured by this scale before and 7 days after the intervention to compare the effect.

Visual Analogue Scale (VAS): The pain degree of each patient was evaluated using 0-10 linear VAS (25). The basic method is to use a vernier approximately 10 cm in length. One of its sides is marked with 10 scales. One end is the 0-score end representing no pain, while the other is the 10-score end representing the most unbearable pain. In the use of this vernier, the graduated side is situated away from the patient who is asked to mark the corresponding position that can represent his/her pain degree (25). The score is identified according to the position marked by the pa-

tient. VAS scores <2 and >3 represent no pain and pain, respectively.

Note: The scores can be interpreted as follows: 0 represents no pain; a score of 1–3 indicates that the patient has slight, tolerable pain; a score of 4–6 indicates that the patient has tolerable pain but suffers from its impact on sleep; a score of 7–10 indicates that the patient has gradually intense pain that is unbearable; and a score of 10 represents the most unbearable pain. In this study, the intervention group and control groups were subjected to VAS measurement with regard to their pain 1 day and 3 days after the limb fracture surgery.

Intervention method

Control group

From the day of admission, each patient in the control group was given routine treatment and nursing of limb fracture. The duty nurse and the attending doctor evaluated the patient's disease and fracture, formulated and implemented corresponding treatment, and delivered health education of fracture rehabilitation exercise. After being discharged from the hospital, each patient was guided to follow the official account of "rehabilitation platform for patients with fracture" online, prompted to pay timely attention to health education knowledge released on the online platform, and encouraged to provide comments or ask questions in the interaction section. One-month follow-up was conducted to understand each patient's functional exercise at home and strengthen the publicity of health education.

Intervention group

In addition to accepting the same routine treatment and nursing provided to the control group, the intervention group received nursing intervention based on Cox's IMCHB as follows:

Management team establishment: In the intervention experiment, eight members from the two hospitals, including two attending doctors and six orthopedic specialist nurses. All members of this team have received training in the theoretical explanation and application of Cox's IMCHB.

Health assessment interaction: On the day after admission, the attending doctor and the duty nurse conducted a one-to-one interview with each patient and his/her family member for 30–40 min. Open-ended questions are used to evaluate comprehensively the background and motivation factors of the patient; and determine the characteristics of the patient.

Health management interaction: According to the content of motivational interviews and the results of questionnaire surveys, management team members, patients, and their families jointly analyzed the main problems existing in health management and formulated the scheme of disease health education and behavior intervention.

In-hospital health management: 1) Protection of fractured limbs. 2) Drug guidance. 3) Functional exercise guidance. 4) Psychological support.

Statistical methods

Statistical analyses were performed using SPSS 22.0 (IBM Corp., Armonk, NY, USA). The measurement data are expressed by $\bar{x}\pm s$, and the enumeration data are expressed by n (%). The comparison between groups was conducted using χ^2 test or independent sample t-test. Paired sample t-test was used before and after the intervention. Statistical significance was considered at $P < 0.05$.

Results

Comparability of the intervention and control groups

The demographic comparison between the control and intervention groups is shown in Table 1. No significant differences in gender, age, marital status, educational degree, occupation, self-rated economic condition, fracture type, and payment type were found between the control and intervention groups. This result indicates that the two groups are comparable.

Table 1: Demographic comparison between the two groups

Item	*Category*	*Control group (N = 58)*	*%*	*Intervention group (N = 60)*	*%*	*χ2*	*P*
Gender	Male	26	44.8	31	51.7	0.55	0.46
	Female	32	55.2	29	48.3		
Age	<35	30	51.7	28	46.7	0.30	0.58
	≥35	28	48.3	32	53.3		
Marital status	Married	29	50.0	23	38.3	1.63	0.20
	Unmarried	29	50.0	37	61.7		
Educational degree	High school and below	34	58.6	32	53.3	0.33	0.56
	College and above	24	41.4	28	46.7		
Occupation	Government position	33	56.9	31	51.7	0.33	0.57
	Non-government position	25	43.1	29	48.3		
Self-rated economic condition	Rich	22	37.9	18	30.0	0.95	0.62
	General	16	27.6	17	28.3		
	Poor	20	34.5	25	417		
Fracture type	Upper limb	19	32.8	14	23.3	1.32	0.52
	Lower limb	21	36.2	24	40.0		
	Mixed	18	31.0	22	36.7		
Payment type	Public expense	22	37.9	20	33.3	0.33	0.85
	Medical insurance	17	29.3	20	33.3		
	Self-funded expense	19	32.8	20	33.3		

Impact of the intervention on depression

Paired sample *t*-test was used to compare the SDS scores of the patients from the intervention and control groups before and after the intervention. The SDS scores of the patients from the intervention and control groups decreased significantly after the intervention ($P < 0.01$). Independent sample t-test was used to compare the SDS scores of the patients from the intervention and control groups before and after the intervention and the difference in their scores. No significant difference in SDS scores was found between the two groups before the intervention. After the intervention, the SDS scores of the patients from the intervention group was significantly lower than those of the patients from the control group ($P < 0.001$), and the difference in SDS scores before and after the intervention was significantly higher in the patients from the intervention group than in those from the control group ($P < 0.001$) (Table 2).

Table 2: Comparison of SDS scores between the intervention and control group before and after the intervention

Group	*Before intervention*	*After intervention*	*Difference before and after intervention*	*t*	*P*
Intervention group (n=60)	66.22±9.62	50.22±11.56	-16.00±9.46	13.096	0.000
Control group (n=58)	65.26±10.41	59.05±12.25	-6.21±15.34	3.082	0.003
t	0.519	-4.026	-4.157		
P	0.604	0.000	0.000		

Impact of the intervention on anxiety

Paired sample *t*-test was used to compare the SAS scores of the patients from the intervention and control groups before and after the intervention. The SAS scores of the patients from the intervention and control groups decreased significantly after the intervention ($P<0.01$). Independent sample *t*-test was used to compare the SAS scores of the patients from the intervention and control groups before and after the intervention and the difference in their scores. The patients from the two groups showed no significant difference in SAS scores before the intervention. After the intervention, the SAS scores of the patients from the intervention group were significantly lower than those of the patients from the control group ($P < 0.001$), and the difference in SAS scores before and after the intervention was significantly higher in the intervention group than in the control group ($P < 0.01$) (Table 3).

Table 3: Comparison of SAS scores between the intervention and control groups before and after the intervention

Group	*Before intervention*	*After intervention*	*Difference before and after intervention*	*t*	*P*
Intervention group (n=60)	65.07±8.87	49.60±11.63	-15.47±10.10	11.861	0.000
Control group (n=58)	64.84±10.13	57.90±12.34	-6.95±15.48	3.419	0.001
t	-0.127	-3.760	-3.528		
P	0.899	0.000	0.001		

Impact of the intervention on sleep quality

Paired sample *t*-test was used to compare the AIS scores of the patients from the intervention and control groups before and after the intervention. The AIS scores of the patients from the intervention and control groups decreased significantly after the intervention ($P < 0.05$). Independent sample *t*-test was used to compare the AIS scores of the patients from the intervention and control groups before and after the intervention and the difference in their scores. No significant difference in AIS score was found between the two groups before the intervention. After the intervention, the AIS score of the patients from the intervention group was significantly lower than that of the patients from the control group ($P < 0.001$), and the difference in AIS scores before and after the intervention was significantly higher in the intervention group than in the control group ($P < 0.001$) (Table 4).

Table 4: Comparison of AIS scores between the intervention and control groups before and after the intervention

Group	*Before intervention*	*After intervention*	*Difference before and after intervention*	*t*	*P*
Intervention group (n=60)	26.02±3.99	16.05±4.47	-9.97±6.69	11.546	0.000
Control group (n=58)	25.45±3.45	23.50±4.20	-1.95±6.19	2.397	0.020
t	0.826	-9.326	-6.753		
P	0.411	0.000	0.000		

Discussions

Impact of the IMCHB-based nursing scheme on negative emotions

Patients with limb fracture are prone to different degrees of tension, fear, and other negative emotions caused by long-term immobilization in bed and decreased self-care ability (12). In the present study, the levels of anxiety and depression de-

creased significantly in the control and intervention groups after the intervention. The patients' mood stabilized after the treatment, with their negative emotions gradually decreasing. The differences in the levels of anxiety and depression before and after the intervention were significantly higher in the intervention group than in the control group, suggesting that the IMCHB-based nursing scheme can effectively alleviate anxiety and depression in patients with limb fracture and restrain their negative emotions. Several reasons contribute to this effect. First, before formulating the intervention scheme, paramedics would seek to understand patients' cognition, emotions, and problems, and mobilize their subjective initiative in the nursing process. Second, patients' anxiety and depression may result, on the one hand, from their physical pain, and on the other hand, from the lack of disease-related knowledge. Therefore, paramedics would offer health education according to their actual situation, eliminate their doubts, and correct their cognition.

Impact of the IMCHB-based nursing scheme on sleep quality

In the present study, the intervention and control groups had better sleep quality after the intervention, indicating that the sleep quality of the patients with limb fracture can gradually improve with the passage of time regardless of whether they received an intervention or not. At the beginning, no significant difference in sleep quality was found between the intervention and control groups. After the intervention, the intervention group had significantly better sleep quality than the control group. This phenomenon can be ascribed to the following reasons: the IMCHB-based nursing scheme requires paramedics to collect patient background factors, intrinsic motivation, cognitive evaluation, and emotional response before administering the intervention and formulate a targeted intervention scheme based on the information collected. For example, after perceiving patients' concern about surgery and postoperative recovery, paramedics can convey disease-related knowledge, nursing knowledge, methods, and precautions to patients and thereby alleviate their anxiety. If patients are worried about the heavy economic burden and pressure they bring to their families, paramedics can communicate with them and their families in time to solve the problem in time and improve their mood.

Impact of the IMCHB-based nursing scheme on pain

The pain of the patients from the intervention and control groups decreased after the intervention, which indicates the gradual reduction of postoperative pain in patients with limb fracture. No significant difference in pain was found between the intervention and control groups before the intervention. After the intervention, the pain score was significantly lower in the intervention group than in the control group, and the difference in pain before and after the intervention was significantly higher in the intervention group than in the control group. This result indicates that the IMCHB-based nursing scheme can accelerate the reduction of pain. This phenomenon may be ascribed to the following reasons. First, the positive interaction between paramedics and patients enables paramedics to trace the degree of pain in patients and give reasonable medication guidance. At the same time, paramedics can formulate personalized living nursing schemes and functional exercise methods for patients according to their conditions and make appropriate adjustments according to the progression of rehabilitation (26). Second, paramedics guide patients to reduce their attention to pain by diverting their attention or following other methods. Under the IMCHB-based nursing scheme, health lectures are facilitated to them and their families according to their specific situation to convey fracture-related knowledge, improve their cognition of the disease, alleviate their anxiety and other negative emotions, and assist patients to receive social and family support. In this way, they can have a good attitude toward treatment and rehabilitation and receive less adverse impact from negative emotions on their pain.

Conclusion

The IMCHB exerted a positive impact on the physical and psychological recovery of patients with limb fracture, making it valuable to be popularized in applications. With the focus on pain, negative emotions, and sleep, relevant data were collected from several patients with limb fracture in this study to analyze the physical and psychological impacts of the IMCHB-based nursing intervention on patients. Results confirmed that the IMCHB could effectively reduce the pain, depression, anxiety, and other negative emotions of patients with limb fracture and improve their sleep quality. Hence, this model has potential application value and provides a new idea for the reform of clinical nursing. However, this study has several limitations. In specific, the results of this study do not cover the continuous nursing research on the joint function rehabilitation of patients after discharge. Considering that joint rehabilitation is also an important evaluation indicator of the effect of surgery and nursing intervention, future studies should also examine the impact of the IMCHB on the joint function of patients with limb fracture after discharge. In this way, the clinical application value of the IMCHB in treating patients with limb fracture can be assessed from multiple perspectives.

Journalism Ethics considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of Interest

The authors declare that there is no conflict of interests.

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