Study on the application of the Internet + nursing service in family rehabilitation of common bone and joint diseases in the elderly

W. YAN[1,2], L. LIU[3], W.-Z. HUANG[1,2], Z.-J. WANG[1], S.-B. YU[1], G.-H. MAI[1], M.-M. MENG[1], S.-Y. CUI[1]

[1]Institute of Rehabilitation Medicine, Foshan Fifth People's Hospital, Foshan, China
[2]Foshan Association of Rehabilitation Medicine, Foshan, China
[3]School of Medicine, Foshan University, Foshan, China

Wen Yan and Lian Liu are both co-first authors

Abstract. – OBJECTIVE: To explore the feasibility of the Internet + nursing service mode in family rehabilitation of elderly patients with osteoarthritic diseases.

PATIENTS AND METHODS: The control group (n=50) received routine rehabilitation treatment procedures and discharge guidance. For the observation group (n=50), extended nursing rehabilitation service was conducted through the Internet + nursing service platform based on the routine treatment in the control group.

RESULTS: (1) The compliance with follow-up of the patients in the observation group was significantly higher than that in the control group; (2) The total satisfaction of patients in the observation group was significantly higher than that in the control group; (3) The VAS (1 month: 4.36±1.15 *vs.* 5.86±1.61, $p<0.05$; 3 months 4.36±1.15 *vs.* 5.86±1.61, $p<0.05$), SAS (1 month: 37.21±14.16 *vs.* 49.31±13.45, $p<0.05$; 3 months 26.73±8.25 *vs.* 40.33±9.50, $p<0.05$), SDS (1 month: 32.36±10.15 *vs.* 46.32±12.61, $p<0.05$; 3 months 27.11±8.08 *vs.* 40.62±11.40, $p<0.05$) and PSQI (1 month: 13.64 ± 1.13 *vs.* 16.31 ± 3.45, $p<0.05$; 3 months 11.54 ± 1.87 *vs.* 15.74 ± 1.36, $p<0.05$) scores in the observational group were significantly lower than that in control group at one month and three months after discharge. The ADL (1 month: 86.86 ± 4.13 *vs.* 74.33 ± 3.44, $p<0.05$; 3 months 90.34 ± 7.87 *vs.* 78.52 ± 6.36, $p<0.05$) scores in the observational group were significantly higher than that in control group at one month and three months after discharge.

CONCLUSIONS: The extended rehabilitation nursing management for family rehabilitation of elderly patients with osteoarthritic diseases through the Internet + nursing service is a family rehabilitation model suitable for elderly patients with osteoarthritic diseases in China and has positive significance in developing a diversified medical nursing model.

Introduction

The "Internet + nursing service" is a new cooperative nursing model called the "Internet-hospital-community-family" formed in recent years, which uses information technology to carry out one-stop intelligent medical and nursing services. In 2019, the state launched a pilot project to promote the "Internet + nursing service", focusing on the elderly or disabled elderly, convalescent patients, end-stage patients, and other groups with impaired mobility[1-3]. The pilot project has achieved positive results and has become an effective method in the extended rehabilitation and nursing management of chronic diseases[4]. However, there are few reports on the "Internet + nursing services" in common elderly osteoarthritic diseases.

With the increasing aging population, the number of elderly patients with osteoarthritic diseases increases yearly. Common osteoarthritic diseases in the elderly include senile cervical spondylosis, senile lumbar disc herniation, senile hip osteoarthritis, senile knee osteoarthritis, senile osteoporotic hip fracture, and senile osteoporotic vertebral fracture. These diseases seriously affect the function and quality of the independent life of the patients. Long-term suffering and huge consumption of medical resources have become tremendous mental pain and a heavy economic burden for patients, families, and society[5]. Therefore,

Corresponding Author: Wenzhu Huang, MD; e-mail: xqhwz@163.com

it is of great clinical significance to implement full-cycle rehabilitation for osteoarthritic diseases among the elderly.

Currently, China has established a preliminary three-level rehabilitation network covering a full-cycle rehabilitation service system, including treatment-institutional rehabilitation-community-site/family rehabilitation-disability monitoring[6,7]. Among those, the development of family rehabilitation is still in an exploratory stage, and there is no perfect model for family rehabilitation of osteoarthritic diseases in the elderly. This study conducted an extended rehabilitation nursing management for family rehabilitation of elderly patients with osteoarthritic diseases through the "Internet + nursing service". It aimed to explore a family rehabilitation model suitable for osteoarthritic diseases in the elderly in China and achieved good results.

Patients and Methods

Study Object

A total of 100 elderly patients with osteoarthritic diseases diagnosed and treated in Foshan Fifth Hospital Affiliated to Foshan University, from October 2021 to March 2022, were selected as the research participants. The sample included 31 males and 69 females aged 65.68±6.81 years old. There were 39 cases of osteoporosis, 25 cases of cervical spondylosis, 29 cases of lumbar disc herniation, and 7 cases of knee osteoarthritis. According to the random number table method, patients were divided into two groups, the observation and control groups, with 50 cases in each. There was no significant difference in the general information between the two groups ($p>0.05$). So, the two groups were comparable.

Inclusion Criteria

Patients who met the following inclusion criteria were enrolled in the observation group: (1) being diagnosed with senile osteoarthritic diseases by CT or MRI (senile cervical spondylosis, senile lumbar disc herniation, senile hip osteoarthritis, senile knee osteoarthritis, senile osteoporotic hip fracture, and senile osteoporotic vertebral fracture); (2) stable condition; (3) 60-80 years old; (4) having good understanding and communication skills, and being able to use WeChat to communicate; (5) having smartphones and being proficient in using WeChat; (6) sign the informed consent form.

Exclusion Criteria

Participants who met any of the following criteria were excluded from this study: (1) Those with impaired verbal communication; (2) those with a combination of serious physical (heart, brain, and kidney diseases) or mental diseases; (3) patients who voluntarily withdrew from the study during the intervention.

This study strictly adhered to the ethical principles of informed consent, confidentiality, and being beneficial and harmless. This study was approved by the Medical Ethics Committee of the Foshan Fifth Hospital Affiliated to Foshan University [No. 2021023] and registered in the National Medical Research Registration System (No. MR-44-21-015648).

Operation Steps

The "Xixin Health" Internet + nursing service platform was established by Beijing Neusoft Xikang Information Technology Co., Ltd. (Beijing City, Beijing, China).

The control group received routine rehabilitation treatment procedures and discharge guidance. After discharge, the patients were instructed to perform functional rehabilitation training according to the routine with 2-3 times/day functional exercise. Routine telephone follow-up was conducted until three months after discharge. Regular follow-up: during the first month after discharge from the hospital, follow-up was conducted once a week and every two weeks in the second month. For the observation group, extended nursing service was carried out through the Internet + nursing service platform based on the routine treatment in the control group. The patients were followed up and guided to carry out continuous functional rehabilitation training. Specific implementation methods: (1) all patients in the observation group were included in the WeChat group "rehabilitation of elderly osteoarthritic diseases". The Internet + service management team was composed of nurses, rehabilitation physicians, and rehabilitation therapists. According to the requirements of the patients' condition, a nurse was designated for writing and sending health education content, the rehabilitation physician was responsible for guiding the formulation of functional training programs, and the rehabilitation therapist was responsible for guiding the implementation of functional training. The pushed content was jointly reviewed and approved by the members of the Internet + service management team; (2) The Internet + nursing application training was conducted

Table I. The comparison of the compliance of return visits between the two groups of patients (cases, %).

Group	n	Excellent	Good	Poor	Good compliance
Control group	50	15 (30.0)	20 (40.0)	15 (30.0)	35 (70.0)
Observation group	50	36 (72.0)	13 (26.0)	1 (2.0)	31 (98.0)

Note: Compared with the control group in the same period, $p<0.05$.

before the discharge to ensure that patients could successfully use the Internet + nursing service platform and could interact through WeChat; (3) The follow-up files of the Internet + nursing service rehabilitation management for patients with "rehabilitation of elderly osteoarthritic diseases" were established, including follow-up, education, and guidance for patients and their families to carry out home rehabilitation for pain, diet, psychology, medication, and functional training. An appointment was made as required to assist the patients in conducting home rehabilitation training and nursing through the Internet + nursing service platform.

Observation Indicators

(1) Patient compliance was categorized into three levels -Excellent: patients adhered to the doctors' advice and had return visits to the clinic on time; Good: patients had return visits to the hospital on time, and the total number of return visits was more than five times; Poor: the number of return visits within three months was less than five times. Excellent and good levels were regarded as good compliance. (2) The patient satisfaction questionnaire was divided into four levels: excellent, good, average, and poor. (3) Pain score: Visual analog scale (VAS) was used to compare the pain scores for the two groups of patients. (4) The patients' emotional state changes: Self-rating anxiety scale (SAS) was used to evaluate the patients' anxiety symptoms, with a SAS score of more than 50 representing anxiety. The patients' depressive symptoms were scored using the Self-rating depression scale (SDS), with a SDS score of more than 53 representing depression. The "Questionnaire Star Platform" was used to evaluate SAS and SDS. (5) Sleep quality status. The Pittsburgh sleep quality index (PSQI) was used for sleep quality evaluation. The PSQI had a total of 21 points. The lower the score, the better the sleep quality it indicated. (6) Activities of daily living (ADL): The Barthel index (BI) was used to evaluate the daily living ability of the patients. The total ADL score was 100 points, and the higher the score, the stronger the daily living ability.

Statistical Analysis

SPSS 22.0 statistical software (SPSS IBM, IBM, Armonk, NY, USA) was used for data analysis. The measurement data were expressed as means and standard deviations. The *t*-test was used for comparison between and within groups. Enumeration data were analyzed by the χ^2-test. $p<0.05$ indicated that the differences were statistically significant.

Results

Comparison of the Compliance of the Return Visits Between the two Groups of Patients

The follow-up rates of patients in both groups were 100.0%. The proportion of good compliance of return visits in the observation group was 98.0%, significantly higher than in the control group (70.0%). The difference was statistically significant ($p<0.05$), as shown in Table I.

The Comparison of Patient Satisfaction Between the Two Groups

The results showed that compared with the control group in the same period, the total satisfaction of patients in the observation group (96.0%) was significantly higher than in the control group (34.0%), and the difference was statistically significant ($p<0.05$). The proportion of patients with poor satisfaction in the observation group was 0.0%, and that in the control group was 26.0%, as shown in Table II.

The Comparison of Pain Scores Between the Two Groups of Patients

Before discharge, the VAS scores in control group and the observation group were 6.12±1.30 and 6.27 ± 1.52, respectively. There were no significant differences between two groups ($p> 0.05$). The VAS scores were significantly lower than baseline in both observation and control group ($p< 0.05$). The VAS scores in the observational group

Table II. The comparison of patient satisfaction between the two groups (cases, %).

Group	n	Excellent	Good	Average	Poor	Total satisfaction
Control group	50	5 (10.0)	12 (24.0)	20 (40.0)	13 (26.0)	17 (34.0)
Observation group	50	29 (58.0)	19 (34.0)	2 (4.0)	0 (0.0)	48 (96.0)

Note: Compared with the control group in the same period, $p<0.05$.

were significantly lower than that in control group at one month and three months after discharge (1 month: 4.36±1.15 *vs.* 5.86±1.61, $p<0.05$; 3 months 4.36±1.15 *vs.* 5.86±1.61, $p<0.05$).

The Comparison of SAS and SDS Scores Between the Two Groups

There was no significant difference in SAS and SDS scores between the two groups before the intervention ($p>0.05$). The SAS and SDS scores in the first and third months after discharge were improved compared to those before the intervention. The scores of the observation group were significantly better than those of the control group ($p<0.05$), as shown in Tables III and IV.

The Comparison of PSQI Scores Between the Two Groups

There were no significant differences between the observation group and the control group with regard to the PSQI scores (17.34±2.05 *vs.* 17.81±2.12, $p>0.05$). The PSQI scores were significantly lower than baseline in both observation and control group ($p<0.05$). The PSQI scores in the observational group were significantly lower than that in control group at one month and three months after discharge. (1 month: 13.64 ± 1.13 *vs.* 16.31 ± 3.45, $p<0.05$; 3 months 11.54 ± 1.87 *vs.* 15.74 ± 1.36, $p<0.05$).

The Comparison of the ADL Scores Between the Two Groups of Patients

There were no significant differences between the observation group and the control group regarding the Barthel Index scores (71.89 ± 3.12 *vs.* 72.37 ± 2.72, $p>0.05$). The Barthel Index scores were significantly higher than baseline in both observation and control group ($p< 0.05$). The Barthel Index scores in the observational group were significantly higher than that in control group at one month and three months after discharge (1 month: 86.86 ± 4.13 *vs.* 74.33 ± 3.44, $p<0.05$; 3 months 90.34 ± 7.87 *vs.* 78.52 ± 6.36, $p<0.05$).

Discussion

The ultimate treatment goals of senile osteoarthritic diseases are to alleviate or eliminate pain and improve joint function and patients' quality of life. After returnin g to the community and family, the elderly osteoarthritis patients need to continue the follow-up, nursing, and medical treatment. These measures provide guidance to improve the family rehabilitation capacity of the elderly osteoarthritis patients, help patients' recovery, improve the prognosis after the discharge, and improve the functional status and quality of life of the patients. Community and family rehabilitation enables patients to carry out rehabilitation exercises in a familiar living environment, which is more encouraging to implement long-term rehabilitation for elderly osteoarthritic diseases, save medical costs and increase social and economic benefits. However, due to the lack of knowledge regarding the importance of patients' role in the rehabilitation of elderly osteoarthritic diseases and a lack of effective extended rehabilitation nursing management programs for elderly osteoarthritic diseases, the majority of patients do not carry out standardized family rehabilitation after discharge.

Table III. The comparison of self-rating anxiety scale (SAS) scores between the two groups (score $\bar{x} \pm S$).

Group	n	SAS		
		Before intervention	1st month	3rd month
Control group	50	50.23 ± 16.21	49.31 ± 13.45#	40.33 ± 9.50*
Observation group	50	50.66 ± 15.32	37.21 ± 14.16#	26.73 ± 8.25*

Note: Compared with the control group in the same period, #$p<0.05$, *$p<0.05$.

Table IV. The comparison of self-rating depression scale (SDS) scores between the two groups (score $\bar{x} \pm S$).

Group	n	SAS		
		Before intervention	1st month	3rd month
Control group	50	53.62 ± 13.30	46.32 ± 12.61#	40.62 ± 11.40*
Observation group	50	53.57 ± 12.62	32.3 6± 10.15#	27.11 ± 8.08*

Note: Compared with the control group in the same period, #$p<0.05$, *$p<0.0.5$

Due to various constraints, China's medical institutions rarely carry out door-to-door nursing services. With the development of information technology and the encouragement and promotion of China's national policies, the integration of nursing and the Internet has become a new trend in developing the domestic nursing industry. Under the reformation and innovation of the nursing service industry in China, the "Internet + nursing service" has been promoted so that more patients can enjoy high-quality and continuous nursing services[8]. The door-to-door nursing service in the United States is well developed. Therefore, many aspects of the service in the United States are worthy of reference in developing the "Internet + nursing service" in China[9,10].

The compliance of patients affects the implementation of rehabilitation training[11]. This study showed that the compliance and satisfaction of patients in the observation group were significantly higher than those in the control group, suggesting that patients readily accepted the "Internet + nursing service" platform for extended rehabilitation nursing management in elderly osteoarthritic diseases. Hence, it is conducive to the development of family rehabilitation.

Pain is the primary clinical manifestation of osteoarthritic diseases in the elderly. Pain reduces the comfortable experience of patients and causes an enormous psychological burden. Due to fear of pain, patients reduce exercise rehabilitation or even give up postoperative rehabilitation training, resulting in significant loss of limb function, and daily living capacity, leading to declined quality of life[12,13]. This study showed that the improvement of visual analog scores of patients in the observation group was better than that in the control group in the first and third months after discharge. Therefore, it suggests that extended rehabilitation nursing management can effectively reduce the pain of elderly patients with osteoarthritic diseases, eliminate the mental tension caused by pain, and improve the quality of life of elderly patients with osteoarthritic diseases.

Elderly patients with osteoarthritic diseases often have emotional variations, including anxiety, depression, and poor sleep quality. One study[14] reported that 42.9% of hip fracture patients had depression. Therefore, eliminating emotional disorders is also essential for patients' family rehabilitation. Some reports[15-17] showed that online home management could alleviate pain and negative emotions of patients with osteoarthritis. This study demonstrated that the improvement of SAS, SDS, and PSQI scores of patients in the observation group were better than those in the control group in the first and third months after discharge ($p<0.05$). Therefore, extended rehabilitation nursing management through the "Internet + nursing service" has a significant effect on alleviating anxiety and depression and improving sleep quality.

Improving the daily living capacity of elderly patients with osteoarthritic diseases is an important goal of extended rehabilitation nursing management[18,19]. This study showed that the ADL scores of the observation group were higher than those of the control group in the first and third months after discharge. Therefore, the relief or elimination of disturbing emotions such as pain, anxiety, and depression promotes the patients' enthusiasm for rehabilitation training, thus effectively improving the rehabilitation effect of patients and improving their capacity for better daily living.

Conclusions

In this study, the extended rehabilitation nursing management model provided family rehabilitation to elderly patients with osteoarthritic diseases through the "Internet + nursing service". The results showed that extended rehabilitation nursing management of family rehabilitation for elderly patients with osteoarthritic diseases through the Internet + nursing service could effectively reduce the patients' pain, eliminate the patients' tension, and improve the patients' enthusiasm for family rehabilitation training[21-22]. It is

helpful for the recovery of patients. It is suitable for the family rehabilitation model of elderly osteoarthritic diseases in China, which is significant in developing a diversified medical nursing model. The number of cases in this study was relatively less. Therefore, prospective, multi-center, large sample, randomized controlled studies are needed to improve the weaknesses of family rehabilitation to establish a full-cycle rehabilitation service system for the elderly with osteoarthritic diseases.

Conflicts of Interest

Ethics Approval

Informed Consent

Availability of Data and Materials

Fund Project

Acknowledgments

Authors' Contribution

W. Yan, L. Liu and S.-Y. Cui contributed to the literature search, design of the study protocol, drafted the manuscript, data collection. M.-M. Meng, S.-B. Yu and G.-H. Mai contributed to intervention provision, data collection, and data analysis. Z.-J. Wang and W.-Z. Huang contributed to the data analysis, funding acquisition, and trial management. All authors have read and agreed to the published version of the manuscript.

ORCID ID

W. Yan: https://orcid.org/0000-0003-1622-9267
L. Liu: https://orcid.org/0000-0001-9216-5176
W.-Z. Huang: https://orcid.org/ 0000-0002-3601-2885
Z.-J. Wang: https://orcid.org/0000-0003-3316-4821
S.-B. Yu: https://orcid.org/0000-0003-7074-7458
G.-H. Mai: https://orcid.org/0000-0003-3055-3787
M.-M. Meng: https://orcid.org/0000-0001-8698-8192
S.-Y. Cui: https://orcid.org/0000-0001-6824-9716

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