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Original Article

Analysis of effect of high-quality nursing on pain of emergency orthopedic trauma patients and related factors affecting postoperative pain

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Abstract: Objective: The purpose of this study is to analyze the influencing factors of postoperative pain in patients presenting with emergency orthopedic trauma, and to determine the effect of high-quality nursing on pain. Methods: In this prospective study, 78 emergency orthopedic trauma patients were randomized into the research group for high-quality nursing and the control group for routine emergency nursing. The two groups were compared with respect to pain degree, pain resolution time, related clinical indexes, pre- and post-treatment joint range of motion (ROM) and psychological state, as well as nursing satisfaction and complications. Univariate analysis and Logistic regression were carried out to analyze the influencing factors of pain following fractures. Results: Compared with before operation (at baseline), the visual analogue scale (VAS) scores decreased gradually from 1 to 7 days postoperatively in both groups, and were lower in the research group than in the control group in the same time period (all $P<0.05$). Logistic regression analysis revealed that male, anxiety and/or depression as well as general family support were the major factors affecting postoperative pain in patients with traumatic fractures ($P<0.05$). Patients in the research group showed significantly less pain resolution time and evidently shorter time of hospitalization and fracture healing than the control group (all $P<0.01$). Compared with the baseline, ROM scores increased significantly in both groups after intervention, and were higher in the research group than in the control group; Hamilton anxiety (HAMA) and Hamilton depression (HAMD) scores reduced remarkably in the two series, and were even lower in the research group (all $P<0.05$). In comparison with the control group, the nursing satisfaction was higher and the incidence of complications was lower in the research group (both $P<0.05$). Conclusions: Gender, psychological state and family supportive attitudes have certain effects on postoperative pain degree of emergency orthopedic trauma patients. High-quality nursing can relieve postoperative pain degree and adverse psychological state of patients, with fewer complications, higher satisfaction and shorter hospitalization time.

Keywords: Emergency orthopedic trauma, pain, influencing factors, high-quality nursing

Introduction

Different from general orthopedics, the condition develops quickly and the symptoms are serious following traumatic fractures, and improper treatment or intervention measurements can lead to a variety of complications [1]. Pain is one of the key factors affecting the postoperative recovery of orthopedic trauma patients [2]. Clinically, due to patients' different tolerance to pain, there are great differences in the coordination degree of treatment and rehabilitation training. Therefore, it is of great significance to adopt appropriate nursing intervention measurements to control the postoperative pain degree of patients with fractures, so as to bolster the treatment compliance of patients and to improve the clinical treatment effect [3]. However, instead of taking targeted intervention measurements to mitigate the

Table 1. Baseline data ($\bar{x} \pm sd$)

Index	Research group (n=39)	Control group (n=39)	χ^2/t	P
Gender (n)			0.463	0.496
Male	22	19		
Female	17	20		
Age (years)	40.3±4.3	41.2±5.2	0.833	0.407
BMI (kg/m^2)	23.42±2.39	23.20±2.50	0.397	0.692
Fracture location (n)			0.746	0.303
Head and neck region	4	3		
Thoracolumbar spine	19	15		
Arms and legs	12	15		
Spine	4	6		
Injury cause (n)			0.647	0.438
Traffic accident	18	17		
Falling	12	10		
Violence injury	6	9		
Others	3	3		
Serum albumin (g/L)	42.20±3.58	43.09±4.43	0.976	0.332
Underlying disease (n)			2.333	0.311
Diabetes	1	2		
Hypertension	9	11		
Hyperlipidemia	4	1		
Blood flow velocity at fracture site (cm/s)	33.30±5.49	31.94±4.30	1.218	0.227

Note: BMI: body mass index.

pain of patients following fractures, traditional post-fracture nursing measures are mostly the basic nursing of some fractures, such as debridement, bandaging and fixation, which can no longer meet the nursing needs of patients with traumatic fractures [4].

High-quality nursing, on the contrary, is a nursing mode that centers on the patient, strengthens basic nursing concept, deepens nursing professional connotation, and implements nursing responsibility in an all-round way, in an attempt to improve the overall nursing service level; and compared with traditional nursing, it pays more attention to patients' needs [5]. In recent years, high-quality nursing has been widely applied in departments such as general surgery, obstetrics and gynecology, while in trauma orthopedics, only the impact on patients' psychology and prognosis has been widely studied [6-8]. In view of this, this study focuses on the factors affecting the pain of emergency orthopedic trauma patients, and analyzes the effect of high-quality nursing on relieving pain, aiming to provide reference for the choice of nursing models and pain relief measurements for emergency orthopedic trauma patients.

Materials and methods

General information

From March 2019 to February 2020, 78 patients with traumatic fractures admitted to the emergency department of Chun'an County Hospital of Traditional Chinese Medicine were randomized into the research group (n=39) and the control group (n=39) by random number table method, for a prospective study. Inclusion criteria: patients 1) aged 18-60 years; 2) with obvious fracture symptoms and confirmed diagnosis after X-ray or other imaging examination; 3) with elective internal fixation surgery; 4) with signed informed consent. Exclusion criteria: patients 1) with pathological fractures; 2) with life-threatening complex fractures; 3) with multiple fractures; 4) with history of thrombosis; 5) with dysfunction of organs such as liver and kidney; 6) with blood system diseases or coagulation dysfunction; 7) with abnormal sensitivity to pain; 8) participated in other research projects; 9) in pregnancy or lactation. The general data of two groups of patients are shown in **Table 1**. This study was approved by the Medical Ethics Committee of

Chun'an County Hospital of Traditional Chinese Medicine.

Methods

Preoperative blood flow velocity at the fracture site was determined by imaging examinations such as digital subtraction angiography (DSA) in all patients. During the perioperative period, the control group was given routine emergency nursing, including debridement, pressure dressing, reasonable fixation, establishment of venous passage, and prevention of ischemic shock.

The research group adopted high-quality nursing, specifically as follows:

(1) Preoperative nursing: preoperative education: the matters needing attention after surgery, including but not limited to the methods of defecation and urination in bed, coughing and expectoration, as well as postoperative body position and bedside adjustment, were explained to patients preoperatively to enable them to grasp the related knowledge as soon as possible and avoid postoperative discomfort and severe pain that affect the acceptance of knowledge. Preoperative psychological counseling: before surgery, the nursing staff explained to patients the necessity and effectiveness of surgery to enhance their confidence in overcoming the disease. For patients with obvious adverse psychology, targeted psychological counseling was provided to inform them that the surgeon had rich experience to eliminate their fear. In addition, patients were told the methods of self-regulation and informed that a good attitude was conducive to smooth operation and postoperative recovery, so that they could greet the operation with the best attitude [9].

(2) Intraoperative nursing: intraoperatively, the nursing staff paid close attention to the changes of the patient's vital signs and timely informed the surgeon. The sense of teamwork was also enhanced among the nursing staff to shorten the operation time and reduce the risk of intraoperative infection.

(3) Postoperative nursing: nursing of postoperative complications: given that patients with traumatic fractures had to stay in bed for a long time after operation, it was easy to cause complications such as pressure sores and deep venous thrombosis (DVT) of lower limbs; hence, the family members were instructed to frequently assist patients to change their posture and elevate lower limbs, and the patient was encouraged to exercise leg lifting as soon as possible to prevent DVT [10]. Antibiotics were routinely administrated to prevent postoperative infection. For patients with drainage tubes, the nursing staff paid special attention to whether there were abnormalities in the amount and color of drainage fluid, and reported to the attending physician once any abnormality was found. If the patient needed to cough or expectorate, he/she was informed to follow the method described before operation to avoid pulmonary infection caused by sputum not being discharged in time. In addition, patients were advised to eat more fruits and high-fiber foods to prevent constipation. For those who suffered from constipation, abdominal massage was performed, and if necessary, enema as prescribed by the doctor [11]. Postoperative pain nursing: analgesic pump was used after operation, and the dosage of analgesic drugs can be appropriately increased when the patient felt strong pain.

Outcome measures

Primary endpoints: (1) The pain degree of patients as assessed by Visual Analogue Scale (VAS) was compared between the two series before and 1 d, 3 d and 7 d after surgery [12]. The closer the score was to 10, the more severe the pain was.

(2) Pain resolution time, fracture healing time and hospitalization time were compared between the two groups. Of these, the fracture healing time was calculated by X-ray showing callus formation and the clinical healing stage of the fracture [12].

Secondary endpoints: (1) The motor assessment scale (MAS) was used to evaluate the range of motion (ROM) of patients in the two groups before and after intervention. On a 100-point scale, the core was in direct proportion to the recovery of the patient's joint ROM [13].

(2) Hamilton Anxiety (HAMA) and Hamilton Depression (HAMD) scales were employed for anxiety and depression assessment of patients before and after intervention, and the degree of anxiety and depression increased with the scores [14, 15].

(3) Nursing satisfaction of patients in the two groups was evaluated at discharge [16]. Satis-

Table 2. Comparison of VAS scores ($\bar{x}$ ± sd, score)

Group	Before surgery	1 day after surgery	3 days after surgery	7 days after surgery
Research group (n=39)	7.31±1.39	5.84±1.10#	3.98±0.99#	2.10±0.74#
Control group (n=39)	7.22±1.30	6.44±1.35#	4.50±1.02#	2.55±0.88#
t	0.295	2.152	2.285	2.444
P	0.769	0.035	0.025	0.017

Note: Compared with before surgery, #P<0.05. VAS: Visual Analogue Scale.

Table 3. Influencing factors of postoperative pain - Univariate analysis ($\bar{x}$ ± sd)

Index	n	VAS scores	t	P
Gender (n)			2.038	0.045
Male	41	5.04±1.13		
Female	37	4.53±1.08		
Age (years)			1.707	0.188
≤35	28	5.50±1.20		
36~60	35	4.92±1.36		
≥60	15	5.02±1.19		
Fracture location (n)			1.395	0.251
Head and neck region	7	5.45±1.32		
Thoracolumbar spine	34	5.79±1.40		
Arms and legs	27	5.23±1.22		
Spine	10	5.03±1.03		
Psychological state (n)			2.855	0.006
No anxiety, depression	62	4.57±1.04		
Anxiety and/or depression	16	5.64±1.40		
Educational level (n)			0.773	0.442
Junior high school the following	45	5.74±1.64		
More than a high school	33	5.44±1.73		
Family Support attitude (n)			2.356	0.021
Good	50	4.70±1.30		
General	28	5.34±1.06		

Note: VAS: Visual Analogue Scale.

faction = (satisfaction + basic satisfaction) cases/total cases ×100%.

(4) The occurrence of complications such as DVT, pulmonary infection, urinary system infection and constipation were compared between the two groups. Total incidence of complications = number of cases with complications/total number of cases ×100%. Each complication was calculated independently even if more than one occurred in the same patient.

Statistical analysis

SPSS 20.0 was used for data statistics. The counting data were expressed as (n/%), and analyzed by χ^2 test. The measurement data were expressed as ($\bar{x}$ ± sd). Independent t-test was used for comparison between groups, and paired t-test was utilized for intra-comparison before and after intervention. Univariate analysis was carried out to analyze the factors with significant differences in postoperative VAS scores, and then Logistic regression analysis was performed to analyze the influencing factors of post-fracture pain, with gender (male), psychological state (with anxiety and/or depression) and different supportive attitudes of family members (general family support) as independent variables while postoperative VAS scores as dependent variables. *P* value <0.05 was considered to be statistically significant.

Results

Baseline data

The baseline data differed insignificantly between the two series (P>0.05), indicating comparability. See **Table 1**.

Comparison of VAS scores

Compared with the baseline, VAS scores gradually decreased from 1 to 7 days postoperatively in both groups, and were lower in the research group than in the control group in the same time period (all P<0.05). See **Table 2**.

Influencing factors of postoperative pain

Univariate analysis: Univariate analysis indicated that the postoperative VAS scores varied significantly among fracture patients with different gender, psychological state and family supportive attitudes (all P<0.05). See **Table 3**.

Logistic regression analysis: Logistic regression analysis was performed with gender (male), psychological state (with anxiety and/or depression) and different family supportive

Table 4. Influencing factors of postoperative pain - Logistic regression analysis

Index	Wald χ^2	OR	P	95% CI
Gender	5.686	3.506	0.043	1.804~4.896
Psychological states associated with anxiety and/or depression	6.483	4.495	0.020	2.195~6.505
Family members are generally supportive	5.949	3.944	0.029	2.027~5.543

Table 5. Related clinical indicators ($\bar{x}$ ± sd, d)

Group	Pain relief time	Hospital stay time	Fracture healing time
Research group (n=39)	2.0±0.8	14.5±3.2	67.7±8.6
Control group (n=39)	3.4±1.3	17.2±4.2	81.1±9.2
t	5.728	3.193	6.645
P	<0.001	0.002	<0.001

Table 6. ROM, HAMA and HAMD scores ($\bar{x}$ ± sd, score)

Group	ROM score	HAMA score	HAMD score
Research group (n=39)			
Before intervention	56.69±6.50	10.94±2.15	7.50±1.03
After intervention	87.70±8.44*,#	6.60±1.49*,#	5.33±1.09*,#
Control group (n=39)			
Before intervention	57.35±7.49	10.55±2.04	7.13±1.33
After intervention	74.40±7.93*	8.04±1.80*	6.02±1.06*

Note: Compared with Before intervention of Research Group, *P<0.05; compared with After intervention of Control Group, #P<0.05. ROM: range of motion; HAMA: hamilton anxiety; HAMD: hamilton depression.

Table 7. Nursing satisfaction (n, %)

Group	Satisfaction	Basic satisfaction	No satisfaction	Satisfaction
Research group (n=39)	19 (48.72)	17 (43.59)	3 (7.69)	36 (92.31)
Control group (n=39)	13 (33.33)	16 (41.03)	10 (25.64)	29 (74.36)
χ^2	1.908	0.053	4.523	4.523
P	0.167	0.819	0.033	0.033

attitudes (general family support) as independent variables and VAS scores as dependent variables. The results revealed that male, anxiety and/or depression and general family support were the main factors affecting postoperative pain in patients with traumatic fractures (P<0.05). See **Table 4**.

Related clinical indicators

Patients in the research group showed significantly less pain resolution time and evidently shorter hospitalization time and fracture healing time than the control group (all P<0.01). See **Table 5**.

ROM, HAMA and HAMD scores

Compared with the baseline, the ROM scores increased significantly in both groups after intervention, and were higher in the research group than in the control group; HAMA and HAMD scores reduced notably in the two series, and were even lower in the research group (all P<0.05). See **Table 6**.

Nursing satisfaction

The nursing satisfaction in the research group was higher than that in the control group (P<0.05). See **Table 7**.

Complications

The total complication rate in the research group during hospitalization was 2.56% (1 case of constipation), which was lower than 15.38% in the control group (1 case each of DVT, pulmonary infection and urinary system infection, plus 3 cases of constipation). See **Figure 1**.

Discussion

Among various factors affecting postoperative pain of orthopedic trauma patients, pain is one of the key factors influencing their postoperative recovery [17]. Such factors mainly include trauma-related factors and patients' own factors, among which the former mainly includes the trauma itself and surgical operation, while the later primarily covers patients' gender, age, psychological state and educational level [18].

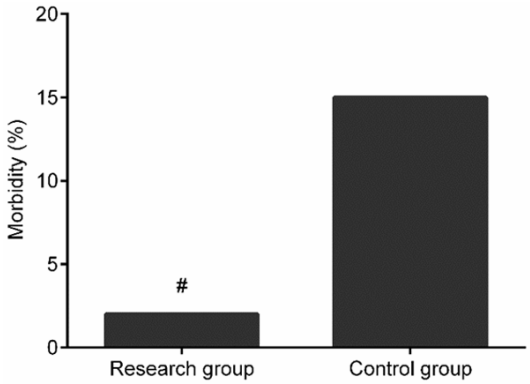

Figure 1. Comparison of complications rate. Compared with control group, #P<0.05.

All the patients enrolled in this study adopted internal fixation surgery, so rather than the type of surgery, other factors were included to explore their impact on postoperative pain of patients. Univariate analysis demonstrated that there were significant differences in postoperative VAS scores among fracture patients with different genders, psychological states and supportive attitudes from family members. Subsequently, Logistic regression analysis was performed on the above indicators with significant differences, and it was found that male, anxiety and/or depression, and general family support were the main factors affecting postoperative pain in patients with traumatic fractures. The results suggest that adverse psychological state and poor family supportive attitude of patients with traumatic fractures can aggravate the postoperative pain degree of patients; moreover, as men may have a lower perception of pain threshold than women, male patients feel more intense postoperative pain. However, this conjecture needs to be confirmed by more studies [19]. In addition, this study observed that patients' age, fracture location and education level had little influence on postoperative pain, which may be due to the small sample size and the uneven distribution of related factors such as fracture site in the included samples.

Different from general orthopedics, most orthopedic trauma patients are from the emergency department, whose condition is urgent and progresses rapidly, plus the fact that most of them need surgical treatment, so the pain is more severe. Hence, postoperative pain control of orthopedic trauma patients is still the main obstacle existed in emergency orthopedic surgery [20]. On the contrary, well-controlled pain not only allows patients to do functional exercise as early as possible, but also helps patients avoid adverse psychological factors such as restlessness caused by pain [21]. And in return, early functional exercise and a good psychological state contribute enormously to the improvement the overall therapeutic effect and the early recovery of patients [22]. Therefore, for orthopedic trauma medical staff, postoperative pain control should be regarded as a crucial index to evaluate the treatment effect, and reasonable measurements should be taken to reduce surgical pain as much as possible. In this study, the patients in the research group received high-quality nursing. It was observed that the VAS score of patients in the two groups decreased gradually from 1 day to 7 days after surgery compared with that before surgery, and the score in the research group were obviously lower than those in the control group at the same time point, suggesting that applying high-quality nursing to emergency orthopedic trauma patients could significantly reduce their postoperative pain. The research by Stanghelle et al. also showed that high-quality nursing had obvious effect on alleviating postoperative pain of fracture patients [23].

Generally, patients with traumatic fractures have to stay in bed for a long time after surgery, which is easy to cause constipation, pressure ulcers, DVT and pulmonary infection [24]. The results of this study showed that the total incidence of complications during hospitalization in the research group (2.56%) was lower than that in the control group (15.38%), suggesting that applying high-quality nursing to emergency orthopedic trauma patients can help reduce the risk of complications. Berggren et al. also believed that comprehensive high-quality nursing interventions could help reduce the incidence of complications during hospitalization in long-term bedridden patients [25]. This is because, compared with routine nursing, high-quality nursing pays more attention to the nursing of postoperative complications, and reduces the occurrence of complications such as pressure sores and constipation by frequently changing body positions, leg lifting exercises, effective cough or expectoration and abdominal massage [26, 27]. In addition, this study found that the research groups pre-

sented significantly less pain resolution time, shorter hospitalization time and fracture healing time, and statistically higher ROM scores than the control group, suggesting that for emergency orthopedic trauma patients, the effect of high-quality nursing was more significant, which can increase the ROM of patients, shorten hospitalization time and promote fracture healing. As the psychological state of patients can affect the degree of postoperative pain, high-quality nursing measures also emphasize the psychological care of patients. The results revealed that the scores of HAMA and HAMD in the research group were lower than those in the control group after intervention, which indicated that high-quality nursing can relieve that adverse emotions of emergency orthopedic trauma patients. What's more, we found that the nursing satisfaction was higher in the research group than in the control group, demonstrating that high-quality nursing was more recognition by emergency orthopedic trauma patients. However, as this study is a single-center clinical trial with limited sample size and the absence of long-term follow-up after discharge, further research is warranted to clarify the influence of in-hospital high-quality nursing on the quality of life of patients after discharge.

To sum up, gender, psychological state and different supportive attitudes of family members exert certain influence on postoperative pain degree of emergency orthopedic trauma patients. High-quality nursing can alleviate postoperative pain degree and adverse psychological state of patients, with fewer complications and higher satisfaction, which is beneficial to shorten hospitalization time and promote fracture recovery of patients.

Disclosure of conflict of interest

None.

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