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Original Article

Effect of predictive trauma care on fracture healing and complications of traumatic fracture patients in emergency department

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Abstract: Objective: To explore the advantages of predictive trauma care in fracture healing and prevention of complications in patients with traumatic fracture. Methods: Through prospective research methods, 80 patients with traumatic fractures were divided into a research group and a control group, each with 40 cases. The control group was given regular emergency care, while the research group was given predictive trauma care. The related clinical indicators, complications and scores on changes in joint range of motion (ROM), mental status and quality of life before and after intervention were compared between the two groups. Results: Compared with the control group, the time of pain relief, fracture recovery and hospital stay of the research group was significantly shortened (all P<0.01). The overall incidence of complications in the research group was lower than that in the control group (5.00% vs 20.00%, P<0.05). For patients with limb fractures, the ROM scores of the two groups after intervention were significantly higher than those before intervention, and the scores of the research group were higher than those of the control group (all P<0.05). Compared with the condition before intervention, the Hamilton Anxiety Scale (HAMA) and Hamilton Depression Scale (HAMD) scores of the two groups of patients were significantly reduced after intervention, and the scores of research group were lower than those of the control group (all P<0.05). Compared with the condition before intervention, the scores of physical function, social function, psychological function and daily life condition of the two groups of patients were significantly increased 3 months after discharge from hospital, and the scores of the research group were significantly higher than those of the control group (all P<0.05). Conclusion: Predictive trauma care can effectively reduce the risk of postoperative complications in patients with traumatic fractures, promote the fracture healing, relieve the patients' anxiety and depression, and improve their quality of life.

Keywords: Predictive trauma care, traumatic fractures, complications

Introduction

After an accidental fracture, patients need to seek medical treatment in time to prevent their condition from getting worse [1]. The fracture site loses motor function after traumatic fracture. Without timely rescue or effective care, the recovery and prognosis of the patient's limb function will be seriously affected. Therefore, effective care is extremely important for the prognosis of patients and it is essential for patients to receive appropriate nursing interventions as early as possible to promote fracture healing and improve the prognosis [2, 3]. Regular post-fracture nursing methods are likely to delay the best treatment time for fractures, while things are different with predictive trauma care [4].

Predictive trauma care is a more widely used clinical care method in recent years. Compared with regular nursing intervention methods, the advantage of predictive trauma care lies in its predictability. By predicting the possible adverse effects or complications, targeted nursing interventions will be carried out in advance [5]. In recent years, predictive trauma care has been widely used in different departments such as general surgery, brain surgery, etc., which has shown significant preventive effects on the occurrence of complications during hospitalization [6, 7]. For patients with traumatic fracture, they need to stay in bed for a long time after surgery, which makes them vulnerable to constipation, pressure sores, DVT, lung infections, etc. [8]. It has been found that the application of predictive trauma care in orthopedic trauma

can significantly reduce the risk of accidental adverse effects [9]. This study mainly explores the advantages of predictive trauma care in fracture healing and prevention of complications in patients with traumatic fractures, and compares it with the regular emergency care, aiming to provide a reference for the selection of nursing methods for patients with traumatic fracture in the emergency department.

Materials and methods

General information

Through prospective research methods, 80 traumatic fracture patients admitted to Affiliated Hospital of Jiangnan University from January 2019 to January 2020 were selected and divided into two groups according to the random number table method, a research group and a control group, with 40 cases in each group. Inclusion criteria: patients aged from 18 to 55 years old; patients had obvious clinical symptoms of fracture confirmed by imaging examination; patients signed the informed consent and knew the purpose of this study. Exclusion criteria: patients had blood system diseases; patients had a history of thrombosis; patients had coagulopathy, malignant tumors, and mental illness; patients participated in other research projects. This study was approved by the medical ethics committee of Affiliated Hospital of Jiangnan University.

Method

The control group was given regular emergency care after fracture, such as debridement, compression bandaging, fixation, establishment of venous access, mainly to prevent the occurrence of ischemic shock. And tracheotomy was conducted for those unable to breathe spontaneously [10].

The research group was provided with predictive trauma care with the following steps (1) Established a special nursing team, which was composed of orthopedic nurses and general nurses. Nurses would learn about first aid and nursing of traumatic fracture. Orthopedic nurses were designated as the head nurses, who would randomly check the general nurses' acquisition on nursing of traumatic fracture. They would urge team members to improve the skills of general nurses on first aid and their nursing level. (2) Predictive psychological care: Nurses would communicate face-to-face with patients gently, kindly and patiently to gain more trust from them, and provide targeted psychological counseling to those with poor mental status, enhance their self-confidence, and relieve negative emotions [11]. (3) Implemented the predictive infection care: Debridement would be done as gentle as possible. Then antibiotics would be used to prevent wound infection after debridement. Tourniquets would not be wrapped too tightly since they might affect blood circulation. In addition, movement would be cut down to reduce the risk of secondary trauma [12]. (4) Carried out the predictive shock care: Checked the patient's blood type when admitted to the hospital to avoid time loss in waiting for the blood type result when the blood transfusion was needed urgently. Closely monitored the patient's vital signs, and notified the physician in charge in time if the blood pressure or pulse was abnormal. Paid attention to changes in the patient's consciousness. If signs of shock were found (unconsciousness or coma, profuse sweating, pale complexion, etc.), antishock treatment were performed in time, and the patient's shock state was improved through rapid fluid rehydration and oxygen therapy [13]. (5) Performed the predictive asphyxia care: Paid close attention to changes in the patient's arterial oxygen saturation, respiratory rate and other indicators; cleared the airway blockage in time, and if necessary, inserted the trachea to restore the patient's breathing and reduced the risk of asphyxia [14]. (6) Conducted the predictive complication care: Helped patients change their bed positions in time to avoid pressure sores, moved the lower extremities in advance, so as to avoid deep vein thrombosis (DVT).

Outcome measures

Main outcome measures: (1) Related clinical indicators between the two groups were compared, such as time of pain relief, fracture healing and hospital stay. Pain relief time was calculated from the time when the patient's body pain was significantly reduced. The fracture healing time was recorded when X-ray result showed the formation of callus and the fracture matched clinical healing stage. (2) The incidence of complications between the two groups was compared, including pressure sores, DVT, urinary system infection, and nosocomial pneumonia. The total complication rate = num-

Table 1. Comparison of general information between patients of the two groups [n, ($\bar{x}$ ± sd)]

Index	Research group (n=40)	Control group (n=40)	χ^2/t	P
Gender (n)			0.808	0.369
Male	24	20		
Female	16	20		
Age (years)	37.9±4.50	38.4±5.70	0.435	0.664
BMI (kg/m^2)	23.22±2.95	23.10±2.48	0.197	0.844
Fracture site (n)			0.740	0.362
Neck	4	6		
Lumber vertebrae	12	10		
Thoracic vertebra	7	6		
Limbs	12	14		
Spine	5	4		
Trauma causes (n)			1.283	0.202
Traffic accident	18	15		
Falling accident	8	11		
Violence	10	9		
Other causes	4	5		
Having regular care knowledge or not (yes or no)			0.556	0.456
Yes	3	5		
No	37	35		
Serum albumin (g/L)	40.84±5.44	41.64±5.10	0.679	0.499
Other diseases (n)			1.125	0.570
Diabetes	1	2		
Hypertension	7	5		
Hyperlipidemia	3	5		
Velocity of blood flow at fracture site (cm/s)	30.98±4.40	31.37±3.96	0.417	0.678

ber of complication cases/total number of cases × 100%. Different complications in one patient were included in case counting.

Secondary outcome measures: (1) The ROM rating scale was used to assess the patient's joint range of motion before and after intervention [15]. The scale had a total of 100 points and scores were positively correlated with the joint range of motion. (2) The Hamilton Anxiety Scale (HAMA) and Hamilton Depression Scale (HAMD) were used to assess the degree of anxiety and depression before and after intervention [16, 17]. The degree of anxiety and depression became more serious with the increase of the score. (3) The Genetic Quality of Life Inventory-74 (GQOLI-74) was used to assess the quality of life of patients in both groups before intervention and 3 months after discharge [18]. It included four dimensions: physical function, social function, psychological function and daily life condition. The scores of the first three dimensions were from 20 to 100 points, and the daily life condition score was from 16 to 80 points. Scores were positively correlated with the quality of life of patients.

Statistical analysis

SPSS 20.0 was used for statistical analysis. The count data were expressed as n/%. The χ^2 test or Fisher's exact test was used in the analysis of the count data; the measurement data were expressed as mean ± standard deviation ($\bar{x}$ ± sd), and the independent t test was used for comparison. P<0.05 was considered statistically significant.

Results

Comparison of general information between patients of the two groups

There was no significant difference in general information between patients of the two groups (all P>0.05), so they were comparable. See **Table 1**.

Table 2. Comparison of clinical indicators between patients of the two groups [($\bar{x}$ ± sd), d]

Groups	Pain relief time	Fracture recovery time	Hospital stay
Research group (n=40)	2.85±1.31	63.39±8.69	15.5±4.0
Control group (n=40)	3.66±1.17	74.58±9.10	19.8±5.2
χ^2	2.917	5.624	4.145
P	0.005	<0.001	<0.001

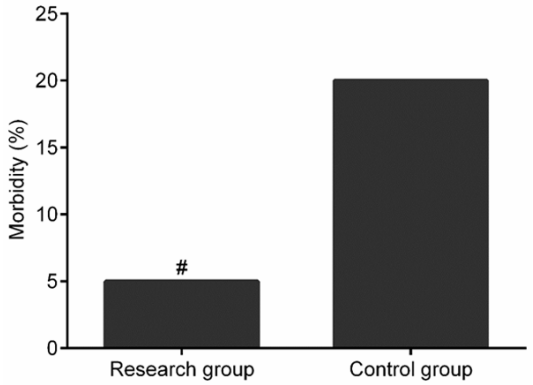

Figure 1. Comparison of the incidence of complications between patients of the two groups. Compared with the control group, #P<0.05.

Comparison of clinical indicators between patients of the two groups

Compared with the control group, the time of pain relief, fracture recovery and hospital stay of the patients in the research group were significantly shortened (all P<0.01). See **Table 2**.

Comparison of the incidence of complications between patients of the two groups

The overall complication rate during hospitalization of patients in the research group was 5.00% (1 case of urinary system infection and 1 case of nosocomial pneumonia), which was lower than that of the control group (20.00%, 1 case of pressure sores, 2 cases of DVT, 2 cases of nosocomial pneumonia, 3 cases of urinary System infection; P<0.05). See **Figure 1** for details.

Comparison of ROM scores of patients with limb fractures between patients of the two groups before and after intervention

For patients with limb fractures, the ROM scores of both groups after intervention were significantly higher than those before intervention, and the scores of the research group were higher than those of the control group (all P<0.05). See **Table 3** for details.

Comparison of HAMA and HAMD scores between patients of the two groups before and after intervention

Compared with those before the intervention, the HAMA and HAMD scores of the two groups were significantly reduced after intervention, and the scores of the research group were lower than those of the control group (all P<0.05). See **Table 4** for details.

Comparison of GQOLI-74 scores between patients of the two groups before and after intervention

Compared with those before intervention, the scores of physical function, social function, psychological function and daily life condition of patients in both groups were significantly increased 3 months after discharge from hospital, and the scores of the research group were significantly higher than those of the control group (all P<0.05). See **Table 5**.

Discussion

Debridement, reduction, fixation, and active prevention of complications are the main emergency measures in hospital for traumatic fracture. Moreover, hospital treatment applied with predictive care can effectively reduce the risk of complications, disability and mortality [19]. In predictive nursing, the foresight of nurses and the related predictive nursing measures are the basis for improving the treatment effect, which will improve both the quality of care and the prognosis of patients [20].

In this study, the total complication rate during hospitalization in the research group was 5.00%, which was significantly lower than 20.00% in the control group. The time of pain relief, fracture recovery and hospital stay of the research group were significantly shortened, indicating that predictive trauma care can more effectively reduce the occurrence of complications in patients with traumatic fracture, shorten the hospital stay, and promote the healing of the fracture site. Langerhuizen et al. pointed out that for fracture patients, predictive trauma care can better reflect the nursing value than the regular care with fewer com-

Table 3. Comparison of ROM scores of patients with limb fractures between patients of the two groups before and after intervention [($\bar{x}$ ± sd), score]

Groups	Time	ROM scores
Research group (n=12)	Before intervention	60.58±5.55
	After intervention	79.82±7.70*,#
Control group (n=14)	Before intervention	61.73±5.09
	After intervention	70.05±5.40*

Note: Compared in the same group before intervention, *P<0.05; compared with the control group after intervention, #P<0.05. ROM: range of motion.

Table 4. Comparison of HAMA and HAMD scores between patients of the two groups before and after intervention [($\bar{x}$ ± sd), score]

Groups	Time	HAMA scores	HAMD scores
Research group (n=40)	Before intervention	11.04±1.05	8.16±1.10
	After intervention	6.79±1.14*,#	6.33±1.02*,#
Control group (n=40)	Before intervention	10.95±1.72	8.03±1.21
	After intervention	8.12±1.09*	7.01±1.05*

Note: Compared in the same group before intervention, *P<0.05; compared with the control group after intervention, #P<0.05. HAMA: hamilton anxiety scale; HAMD: hamilton depression scale.

plications and more positive prognosis for patients [21]. This is because the advantage of predictive care lies in predictability. By predicting the problems that may be encountered in the clinical care, preventive care is carried out in advance, which helps to avoid or reduce potential risks. In addition, based on the predictive trauma care, following the principle of prevention first and then treatment, we can transform negative care into positive one, which has important clinical significance for reducing the occurrence of complications [22]. Meanwhile, regular emergency care lacks the predictability of potential problems in the nursing process. The advantage of predictive trauma care is that it can help reduce the incidence of complications by predicting the condition and giving targeted care in advance, which eventually promotes the prognosis of patients [23].

The ROM rating scale is specifically used to assess the joint mobility of patients with limb fractures [15]. In this study, the ROM scores of limb fracture patients in both groups increased significantly after intervention compared with those before intervention, and the ROM scores of patients in the research group were significantly higher than those of patients in the control group. It suggests that predictive trauma care can more effectively improve the joint mobility of patients with limb fractures and promote the recovery of patients after surgery. Drzyzga et al. pointed out that the psychological state of patients after operation has a significant impact on their postoperative recovery, and the poor mental state of patients is not conducive to their recovery [24]. In this study, the HAMA and HAMD scores of the research group were significantly lower than those of the control group after the intervention, and the GQOLI-74 scores of the research group were significantly higher than those of the control group 3 months after discharge. It suggests that predictive trauma care can more effectively relieve negative emotions of patients with traumatic fracture and improve the quality of life of patients after discharge. This is because the predictive trauma care model requires to establish a special nursing team, and special training and supervision on nurses about acquisition of the fracture nursing knowledge are performed, which improves the theoretical knowledge and clinical operation skills of the nurses to a certain extent, and makes nursing more scientific and reasonable. It ultimately promotes the nursing effect on patients with the obvious improvement of various clinical indicators [25].

However, the sample size of this study is limited, and long-term follow-up studies have not been carried out. Therefore, the impact of predictive trauma care on the quality of life of patients after discharge still cannot be clarified. Large samples and long-term follow-up studies are needed in the future to make further exploration.

In summary, predictive trauma care can effectively reduce the risk of postoperative complications for patients with traumatic fracture, promote the healing of fracture, effectively relieve the patients' negative emotions and finally improve their quality of life.

Table 5. Comparison of GQOLI-74 scores between patients of the two groups before and after intervention [($\bar{x}$ ± sd), score]

Groups	Time	Physical function	Social function	Psychological function	Daily life condition
Research group (n=40)	Before intervention	50.05±5.87	69.48±5.35	67.38±5.98	56.50±5.66
	Three months after discharge	75.57±5.90*,#	78.85±5.86*,#	79.50±6.85*,#	66.60±5.07*,#
Control group (n=40)	Before intervention	49.76±5.63	68.97±5.90	67.96±6.07	55.97±5.90
	Three months after discharge	65.05±5.80*	73.30±6.66*	73.33±6.60*	62.01±5.38*

Note: Compared in the same group before intervention, *P<0.05; compared with the control group three months after discharge, #P<0.05. GQOLI-74: genetic quality of life inventory-74.

Disclosure of conflict of interest

None.

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