Int J Clin Exp Med 2016;9(7):13166-13171
www.ijcem.com /ISSN:1940-5901/IJCEM0020703

Original Article

Safe transport combined with prospective nursing intervention in intra-hospital transport of emergency critically ill patients

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Received November 27, 2015; Accepted February 15, 2016; Epub July 15, 2016; Published July 30, 2016

Abstract: Objective: We aimed to investigate the application values of safe transport combined with prospective nursing intervention in intra-hospital transport (IHT) of emergency critically ill patients. Methods: A sum of 546 critically ill patients receiving and curing in our hospital was randomly enrolled in our study, and divided into convention group and intervention group according to table of random number. Conventional nursing plan and safe transport combined with prospective nursing intervention were applied for comparing waiting time, transport time, nursing care, patient satisfaction, and monitoring items after transport between two groups. Results: Waiting time, transport time and accident rate in convention group were higher than that in intervention group, while, nursing score and patient satisfaction were found higher in intervention group. Higher scores were found in comparison of vital signs, stable condition after transport, nursing score, and management of respiratory tract and digestive tract in intervention group compared with those in convention group. Higher probabilities of unexpected events were observed in convention group comparing with intervention group. Besides, lower degree of satisfaction of receiving department, successful rescue and degree of satisfaction of patients were observed in convention group comparing with intervention group. Conclusion: Our study found that safe transport combined with prospective nursing intervention in intra-hospital transport of emergency critically ill patients presented very good application values in ensuring patients' safety, reasonable arrangement of rescue time, avoiding unnecessary waste of time, improving patients' satisfaction and ensuring the efficiency of the emergency treatment of patients.

Keywords: Emergency, critically ill patients, prospective, nursing intervention, safe transportation

Introduction

Critically ill patients are clinically featured as patients with unstable vital signs, highly changed conditions, and more than two organs had the unstable function. To our knowledge, emergency department (ED) is one of the most important places for saving critically ill patients and one concentrated place for critically ill patients. As for their particular features, critically ill patients required intra-hospital transport (IHT) by the following reasons: (1) emergency department cannot complete the inspection items for the uncharted traumatic condition; (2) patients need to be sent to the operation room, the intensive care unit (ICU) for further treatment [1]. IHT is named the transfer of patients in the hospital for diagnostic or therapeutic objectives or their transfer to specialized units of the hospital [2]. Besides, previous evidence also revealed that IHT has been reported as a risky procedure, especially for critically ill patients [3]. Even the shortest transport may lead to life-threatening complications, and the risk factors causing these complications containing poor monitoring, inadequate medication, mechanical difficulties as well as cardiovascular and respiratory instability [4, 5]. Therefore, due to the crisis situation of critically ill patients, nursing intervention was also one of the most important parts in IHT. Prospective nursing intervention is a comprehensive analysis of specific conditions or potential risk factors of patients by the use of medical care knowledge for predicting and analyzing the nursing problems to minimize pain and acci-

dents of patients via effective preventive nursing measures [6]. Recently, prospective nursing intervention has been widely proved that it can improve the quality of clinical nursing and is of great benefit to critically ill patients in IHT.

Because of the important role of IHT and prospective nursing intervention in critically ill patients, we aimed to prospectively analyze the application values of safe transport combined with prospective nursing intervention in IHT of 546 emergency critically ill patients.

Materials and methods

Ethical statement

This study was approved by the Ethical Committee of Liaocheng People's Hospital. Written informed consents were obtained from all study subjects and/or their legal guardians. This study complied with the guidelines and principles of the Declaration of Helsinki [7].

Clinical data

Between September 2012 and January 2015, a sum of 546 critically ill patients received and cured in emergency department of our hospital was randomly enrolled in our study. Among those 546 critically ill patients, 113 patients had hemorrhagic shock by wound, 83 patients suffered cerebrovascular accident, 96 had cardiovascular or heart problems, 93 had skeletal trauma, 74 suffered impingement cavity damage and 87 were enrolled by the other factors, like poisoning and electric shock. The inclusion criteria were: (1) patients were admitted in emergency department for rescuing, and transported in intra-hospital after rescue; (2) patients with the age around 15~50 years old; (3) patients without communication disorders. According to the different nursing plan during transport, all patients were divided into two groups based on table of random number: convention group and intervention group. In convention group, there were 273 patients (male: n = 152; female, n = 121) with the average age of (49.68 ± 9.26) years old (16~78 years old), while, 273 patients with the average age of (48.64 ± 13.15) years old (15~79 years old) were enrolled in intervention group. No significant difference was found in comparison of disease type, patient's condition and vital sign between convention and intervention groups, which presented comparability.

Study methods

According to the different nursing plan during transport, all patients were divided into the following conditions.

Convention group: Conventional nursing and transport plan were conducted. During transport, the conventional transport bed in our hospital was used, and targeted conventional transport plan was applied for different emergency types of patients.

Intervention group: Safe transport combined with prospective nursing intervening plan was conducted in intra-hospital transport. To be specific, the intervention measures were divided into the following three parts: before, during and after transportation.

Nursing interventions before transport: Patient's condition and vital signs were evaluated by the corresponding doctor and nurse by the existing of relatively risks after the emergency treatment of stable vital signs. The main evaluation items were vital signs, management of respiratory tract and digestive tract, and the use of emergency medicine. If necessary, the corresponding emergency treatment plan for possible problems of patients appeared during transport would be made to prevent accident and do some psychological preparations. Before transport, it was necessary to explain the risk, necessity and possible conditions of transport to the patient or their relatives to let them know the necessity and risk of transport. And, the situation and risk prevention and response measures were also explained to reduce the psychological and mental pressure of patients and their relatives. The transport would be conducted under the active cooperation condition after the acquirement of consent and sign of the patient or their relatives.

Nursing interventions during transport: According to the specific conditions of the patients, the specialized transport measures were formulated in strict accordance with the provisions and system of transport to avoid unnecessary problems and human factors. The specific conditions of patients were examined to ensure no existent of human factors, patients were ready for transport, and no risk factors existed in life sustaining or monitoring instrument. During transport, the sustaining or monitoring instruments were mainly carried with

Table 1. The comparison of baseline characteristics between convention group and intervention group

Categories	Factors	Convention group	Intervention group	χ^2	*P*
Gender	Male	152	145	0.362	0.548
	Female	121	128		
Age	15-45 (years old)	107	86	3.534	0.060
	46-80 (years old)	166	187		
Cause of delivery	Hemorrhagic shock by wound	63	50	1.886	0.170
	Cerebrovascular accident	38	45	0.696	0.404
	Cardiovascular	40	56	3.236	0.072
	Skeletal trauma	42	51	1.050	0.306
	Impingement cavity damage	43	31	2.251	0.134
	Other factors	47	40	0.670	0.413

Table 2. Relevant indexes of intra-hospital transport comparison between convention group and intervention group

Group	Waiting time (min)	Transport time (min)	Nursing score	Degree of satisfaction (%)
Convention group (n = 273)	2.72 ± 1.35	24.49 ± 8.31	86.95 ± 11.54	87.18%
Intervention group (n = 273)	0.37 ± 0.21	17.06 ± 6.23	90.18 ± 8.42	93.77%
t	28.400	11.810	3.737	6.887
P	<0.001	<0.001	0.002	0.009

operative condition and open position, and the related instruments and drugs which have good response to emergencies, were also kept in to deal with possible emergency situations. Besides, protective equipment needs to be proper used, and the right posture of patients in bed also needs to be guaranteed. All corresponding staff should move with the bed jointly which is convenient for observing breathing, consciousness and facial conditions of patients to let them find and deal with emergencies immediately. Furthermore, the life sustaining or monitoring instrument was looked after by specially-assigned person to ensure normal running of instrument, and patients monitored by this instrument were also looked after by them to ensure patients' life safety during transport.

Nursing interventions after transport: After arriving at the destination, the medical staff responsible for the transport should confirm the patient's vital signs and current situation, some measures needed to be taken immediately if the patient's condition was not stable. Handover measures would be started after the patient's vital signs began to stabilize. The specific items for handover were delivery situation of patients, emergency treatment, drug use, tentative diagnosis, special medications, and situation of pipeline intervention. Receiving department might receive and cure the patients after confirming that there was no difference between patients and data.

Outcome measures

The data of waiting time, transport time, nursing score, accident rate, patient satisfaction and the monitoring items after transport were recorded.

Relevant questionnaire was prepared before our study, including the contents of nursing score, score of vital signs, stable disease after transport, score of nursing efficacy and score of channel management. This questionnaire was filled in by all enrolled patients and corresponding nurses after nursing. Nursing score and score of channel management were filled in by patients, while, the remaining items were filled in by nurse. All scores were gathered and analyzed after filling in all the questionnaires.

Statistical analysis

SPSS 12.0 (IBM Corporation, Somers, NY, USA) software was used for statistical analysis. Categorical data were measured by χ^2 test and presented by ratio or percentage. Continuous

Table 3. Unexpected events comparison between convention group and intervention group

Group	Leakage or blockage in infusion	Decreased blood pressure	Decreased oxygen saturation	Fall out of bed	Oxygen interruption	Sputum blockage	Unexpected occurrence (%)
Convention group (n = 273)	7	11	9	6	11	8	19.05
Intervention group (n = 273)	6	9	6	1	4	5	11.36
χ^2	0.079	0.208	0.617	3.618	3.359	0.709	6.266
P	0.779	0.649	0.432	0.057	0.067	0.400	0.012

Table 4. Degree of satisfaction of receiving department comparison between convention group and intervention group

Group	Knowing nothing about diseases	Sending to the wrong department	Receiving no notice	Vein blockage	Degree of satisfaction (%)
Convention group (n = 273)	13	5	9	12	85.610
Intervention group (n = 273)	10	1	4	5	93.940
χ^2	0.409	2.696	1.970	2.975	4.992
P	0.523	0.101	0.160	0.085	0.026

data were presented with mean ± standard deviation (SD) and tested by Student's *t* test. *P* values <0.05 were considered statistically significant.

Results

Baseline characteristics

Comparison of baseline characteristics of the emergency conditions before study, age and gender between convention group and intervention group showed no statistical difference, which presented comparability (all *P*>0.05) (**Table 1**).

Related indexes of transport in intra-hospital

Significant difference was found in comparison of waiting time, transport time, nursing score, accident rate and patient satisfaction between convention and intervention groups (all *P*< 0.05). Waiting time, transport time and accident rate in convention group were all higher than that in intervention group, while, nursing score and patient satisfaction were both found higher in intervention group (all *P*<0.05) (**Table 2**).

Unexpected events during transport

Higher probability of unexpected events was observed in convention group comparing with intervention group (*P*<0.05). No significant difference was found in comparison of leakage or blockage in infusion, decreased blood pressure, decreased oxygen saturation, fall out of bed, oxygen interruption and sputum blockage between convention and intervention groups (all *P*>0.05) (**Table 3**).

Degree of satisfaction of receiving department

Degree of satisfaction of receiving department in intervention group was higher than that in convention group (*P*<0.05). Comparison of rate of knowing nothing about diseases, sending to the wrong department, receiving no notice, vein blockage and degree of satisfaction between convention group and intervention group showed no statistical difference (all *P*>0.05) (**Table 4**).

Monitoring items after transport

Higher data of all monitoring items were found in intervention group comparing with those in convention group, suggesting significant difference in vital sign of two group patients (*P*<0.05) (**Table 5**).

Rate of successful rescue and degree of satisfaction of patients

Rate of successful rescue and degree of satisfaction in intervention group were found higher than those in convention group (both *P*<0.05) (**Table 6**).

Discussion

In the current study, we aimed to investigate the application values of safe transport com-

Table 5. Comparison of the monitoring items after transport between convention group and intervention group

Group	Convention group (n = 273)	Intervention group (n = 273)	t	*P*
T (°C)	37.94 ± 1.15	37.75 ± 1.12	1.360	0.175
HR (times/min)	88.25 ± 12.94	92.37 ± 12.42	2.639	0.009
SBP (mmHg)	147.84 ± 21.23	142.75 ± 16.27	2.186	0.030
DBP (mmHg)	79.58 ± 12.20	75.78 ± 11.74	2.579	0.012
SpO_2 (%)	88.08 ± 7.96	91.07 ± 5.96	3.455	0.001
RR (times/min)	20.09 ± 4.84	18.61 ± 4.66	2.531	0.012

T: temperature; HR: heart rate; SBP: systolic blood pressure; DBP: diastolic blood pressure; SpO_2: Pulse Oxygen Saturation; RR: respiratory rate.

Table 6. Successful rescue and patient satisfaction comparison between convention group and intervention group

Group	Successful rescue (n/%)	Patient satisfaction (n/%)
Convention group (n = 273)	245 (89.74)	221 (80.95)
Intervention group (n = 273)	261 (95.60)	249 (91.21)
χ^2	6.906	11.980
P	0.009	0.001

bined with prospective nursing intervention in IHT of emergency critically ill patients. After the detailed procedures, we found that safe transport combined with prospective nursing intervention in intra-hospital transport of emergency critically ill patients presented very good application values in ensuring patients' safety, reasonable arrangement of rescue time, avoiding unnecessary waste of time, improving patients' satisfaction and ensuring the efficiency of the emergency treatment of patients.

IHT of critically ill patients is a challenging task because patients are often cared for in unusual environment such as hallways, elevators, and procedure areas not typically designed for critical care monitoring or inventions [8]. It has been reported that practice guidelines have been constructed in an attempt to define the standard of care for the IHT of critically ill patients [9]. Statistics showed that incidents of adverse events during IHT range from 6% to approximately 70%, and successful IHT directly depends on the planning and organization of the multidisciplinary team as well as appropriate monitoring and invention during transport [5, 10]. The movement of critically ill patients in intra-hospital for diagnostic purposes represents a daily practice and it is important for the care of patients with numerous damages [11]. Our findings revealed that patients in intervention group had higher nursing score and patient satisfaction compared with convention group.

For further investigating of the influences of transport, previous evidence also proved two main mechanisms: for one thing, the following phenomenon may occur in the movement of patients, including acceleration, deceleration, postures change and movement of difference area, which were deemed as potential factors influencing blood circulation, respiratory, nervous, and psychology [12, 13]. For another, the change in environment, equipment and noise, the hardness of the examining table and the procedure itself were all proved to be factors influencing critically ill patients [14]. Through the study of its internal mechanism, our study applied safe transport combined with prospective nursing intervening plan in intervention group which was concretely divided into three parts in before, during and after transport, respectively. After these three interventions, some of the adverse effects mentioned in the previous mechanism were avoided, and results clarified higher scores in comparison of vital signs, stable condition after transport, nursing score, and management of respiratory and digestive tract in intervention group compared with those in convention group.

Furthermore, with the use of prospective nursing intervention in intervention group, patients presented lower incidence of unexpected events compared with convention group, which was also demonstrated by our study. To be specific, prospective nursing intervention requires nursing staff targeted at the situation which may occur during transport to deploy the relevant nursing work in advance, and develop a reasonable emergency process and conduct situational exercise to improve the level of emergency response [15, 16]. It is also reported that prospective nursing intervention provides quality nursing service in the whole transport, and its purpose is to improve the efficien-

cy of nursing, thus, patients can get successful rescue [17].

In conclusion, our study provided evidence that safe transport combined with prospective nursing intervention in intra-hospital transport of emergency critically ill patients presented very good application values in ensuring patients' safety, reasonable arrangement of rescue time, avoiding unnecessary waste of time, improving patients' satisfaction and ensuring the efficiency of the emergency treatment of patients. So, with the continuous expansion of the research field, it is very urgent for us to further study a more professional and safe transport system for critically ill patients.

Acknowledgements

The authors are grateful to those who gave valuable advices on this paper.

Disclosure of conflict of interest

None.

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