

Original Article

Clinical observation of effects of comprehensive nursing intervention in rescue of acute paraquat poisoning

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Abstract: Objective: The aim of this study was to explore the clinical effects of comprehensive nursing intervention in rescuing acute paraquat (PQ) poisoning. Methods: A total of 286 patients with PQ poisoning, treated in Tang Du Hospital, The Second Affiliated Hospital of Air Force Medical University, from January 2012 to July 2017, were selected as research subjects. Patients were randomly divided into two groups, according to severity of the disease, with 200 cases in the comprehensive nursing group and 86 cases in routine nursing group. The routine nursing group received routine poisoning nursing. The comprehensive nursing group received comprehensive care intervention such as early psychological intervention, early nutritional support, early muscle function training, respiratory function detection, and liver and kidney function tests in addition to routine nursing. Application effects of the two groups were compared. Results: Mortality rates in the comprehensive nursing group were significantly lower than the routine nursing group and differences were statistically significant ($P < 0.05$). Lung injury scores, after nursing, in the two groups were significantly lower than before treatment and differences were statistically significant ($P < 0.05$). Lung injury scores, after nursing, in the comprehensive nursing group were significantly lower than the routine nursing group and differences were statistically significant ($P < 0.05$). Incidence of digestive tract bleeding in the comprehensive nursing group was significantly lower than the routine nursing group and differences were statistically significant ($P < 0.05$). Scores of self-rating anxiety scale and self-rating depressive scale in the comprehensive nursing group were significantly lower than the routine nursing group and differences were statistically significant ($P < 0.05$). Nursing satisfaction of the comprehensive nursing group was significantly higher than the routine nursing group and differences were statistically significant ($P < 0.05$). Conclusion: Comprehensive nursing can effectively reduce the degree of lung injury in patients with PQ poisoning, thus, shortening time of hospitalization and reducing incidence of infection and death.

Keywords: Comprehensive nursing, acute paraquat poisoning, lung injury, digestive tract bleeding

Introduction

Paraquat (PQ), a highly effective herbicide for rapid weeding of any green plant, has been widely used in grassroots rural areas in China. PQ has strong herbicidal functions and belongs to the contact-to-kill type with a powerful devastating effect [1, 2]. According to data, PQ is one of the most widely used herbicides in the world [3]. Since it belongs to pyridine compound and is easily soluble in water, it can be used to indiscriminately kill any contacted plants. However, PQ will lose its effects immediately after contact with soil and minimize its toxicity, thus, it is considered a pollution-free herbicide [4]. Currently, there are more than 100 countries in the world using PQ as their first choice

in agricultural weeding, but some countries have strict regulations regarding use of PQ [5].

In addition to killing green plants, PQ has a strong toxicity to humans and animals. In recent years, there have been increasing reports of cases of poisoning caused by misuse of PQ or suicide by PQ [6]. Most clinical PQ poisoning cases have been due to oral poisoning. PQ causes great damage to human organs through destruction of liver, kidney, and lung function. Especially in the lungs, it can cause chronic pulmonary fibrosis with hypoxemia, one of the major causes of death in patients [7]. Salicylic acid and ambroxol have been used to relieve lung injury in patients with PQ poisoning. However, late recovery of lung function has

Effects of comprehensive nursing intervention in rescue of acute PQ poisoning

Table 1. Patient clinical data

	Comprehensive nursing group	Routine nursing group	t/X ²	P
Gender			0.619	0.431
Male	121	48		
Female	79	38		
Age (years)	34.5±7.5	33.6±5.4	1.006	0.315
Hypertension			1.641	0.200
Yes	15	3		
No	185	83		
Diabetes mellitus			0.015	0.901
Yes	2	1		
No	198	85		
Domicile			0.443	0.505
Countryside	188	79		
City	12	7		
Degree of education			0.098	0.753
<Junior middle school	150	66		
≥Junior middle school	50	20		
Smoking			0.086	0.768
Yes	120	50		
No	80	36		
Excessive drinking			0.193	0.660
Yes	32	12		
No	168	74		
BMI (kg/m ²)	25.32±2.23	25.12±2.45	0.674	0.500
PLT (* 10 ⁹ /L)	157.60±54.60	153.80±56.80	0.533	0.594
WBC (* 10 ⁹ /L)	15.48±5.24	15.23±5.17	0.371	0.710
Hb (g/L)	156.94±33.62	154.37±35.42	0.583	0.560

Note: BMI, body mass index; PLT, platelet; WBC, white blood cell; Hb, hemoglobin.

been unobvious and prognosis has been unsatisfactory [8]. However, in-hospital care plays a crucial role in the recovery of lung function in patients. The concept of comprehensive nursing has added to conventional nursing. Patient mental state, respiratory status, diet, liver, and kidney function are monitored and multiply tracked. Targeted measures are then taken to promote recovery of patients.

This present study compared the clinical effects of comprehensive nursing and routine nursing in acute PQ poisoning, investigating the influence of comprehensive nursing on PQ acute poisoning.

Materials and methods

General information

A total of 286 patients with PQ poisoning, treated in Tang Du Hospital, The Second Affiliated

Hospital of Air Force Medical University, from January 2012 to July 2017, were selected as research subjects and their clinical data were analyzed. Patients were randomly divided into a comprehensive nursing group and routine nursing group, according to severity of patient conditions (comprehensive nursing for patients with severe conditions and routine nursing for patients in mild conditions). Among 200 patients in the comprehensive nursing group, there were 121 males and 79 females, aged between 21-49 years with an average age of 34.5±7.5 years old. Treatment time of patients after poisoning ranged from 35 minutes to 15 hours, with an average treatment time of 75.45±34.82 minutes. Average dosage of medication was 44.28±18.62 mL. There were 86 patients in the routine nursing group, with 48 males and 38 females, aged between 25-43 years old with an average age of

33.6±5.4 years old. Treatment time of patients after poisoning ranged from 50 minutes to 13 hours, with an average treatment time of 68.84±29.25 minutes. Average dosage of medication was 40.84±20.75 mL.

Patient clinical data are shown in **Table 1**. The Ethics Committee of Tang Du Hospital, The Second Affiliated Hospital of Air Force Medical University, approved this research and informed consent was provided.

Inclusion and exclusion criteria

Inclusion criteria: Patients took only PQ without taking other pesticides; imaging examination revealed infiltrative shadows in the lobes of the lungs; no kinship between patients.

Exclusion criteria: Patients aged <18 years old; patients with congenital heart disease, heart failure, and other defects; patients with respira-

Effects of comprehensive nursing intervention in rescue of acute PQ poisoning

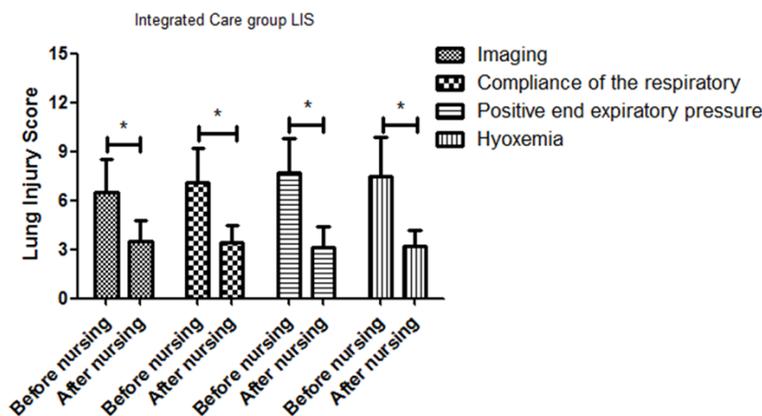


Figure 1. Comparison of LIS in the comprehensive nursing group before and after nursing. LIS, lung injury scores. By comparing imaging examination ($t=17.790$), respiratory system compliance ($t=22.070$), positive end-expiratory pressure ($t=26.340$) and hypoxemia ($t=23.390$) before and after comprehensive nursing, the difference was statistically significant (* $P=0.001$).

tory system diseases or hepatic and renal function defects; patients unwilling to cooperate with treatment; followed-up patients.

Methods

Emergency treatment was carried out for PQ poisoning patients upon admission [9]. First, any clothing contaminated by PQ was removed. Patients with consciousness or full consciousness, with no obvious gastrointestinal bleeding, were given saline mouthwash to clean up residual drugs in the oral cavity. Patients were then treated with gastric lavage and catharsis to reduce absorption of PQ in the body. The operation was performed in a gentle and orderly manner with patient vital signs and consciousness regularly observed. Blood purification treatment was performed on patients that had been poisoned by PQ for more than 2 hours to reduce persistence of PQ in blood. Patient vital signs (electrocardiogram and respiration), and consciousness were observed at the same time. Routine nursing care, disease knowledge education, and admission education were given to patients after their condition stabilized. Patients and families were informed about the hospital and department environment and relevant rules and regulations by responsible nurses. Additionally, diet, poisoning complications, and further treatment plans were explained to patients. Responsible nurses performed other routine nursing tasks such as assessing patient condition and monitoring vital signs.

Patients were given comprehensive nursing care in the presence of suicide, hepatic and renal dysfunction, and severe lung injury. Comprehensive nursing intervention was carried out in the comprehensive nursing group on the basis of routine nursing. Psychological care: After admission to the hospital, psychological counseling was given to patients by observing personality and psychological characteristics. According to patient psychological changes, a variety of counseling methods were conducted rotationally. Recognition of patients and their families

enabled patients to actively cooperate with clinical treatment. Dietary care: Patients were given small meals from a liquid diet, according to their condition. Necessary daily nutritional supplements were provided. Patient consumption of poorly digested and irritating foods was reduced and daily adverse reactions (nausea, vomiting, diarrhea, and so forth) were observed and recorded. Respiratory care: Frequency, rhythm, and depth of patient process of oxygen inhalation were observed. Nurses asked whether patients had hemoptysis, dyspnea, and other conditions and timely adjusted patient posture if they experienced unresponsive breathing; Assisted patients with expectoration; Instructed patients to perform deep breathing and pulmonary function recovery exercises; prevented occurrence of dyspnea, thus, avoiding respiratory failure. Liver and kidney function monitoring: Daily liver and kidney function indicators were monitored by responsible nurses; Occurrence of liver, kidney pain, abdominal distention, hematuria, and other clinical manifestations were observed to assist doctors in avoiding use of drugs that might impair liver and kidney function. Adverse reaction care: Responsible nurses were required to observe and monitor adverse reactions caused by drugs and to remind patients to drink more hot water to speed up circulation. This could effectively increase the excretion rate of drugs, thereby reducing and avoiding occurrence of infection.

Effects of comprehensive nursing intervention in rescue of acute PQ poisoning

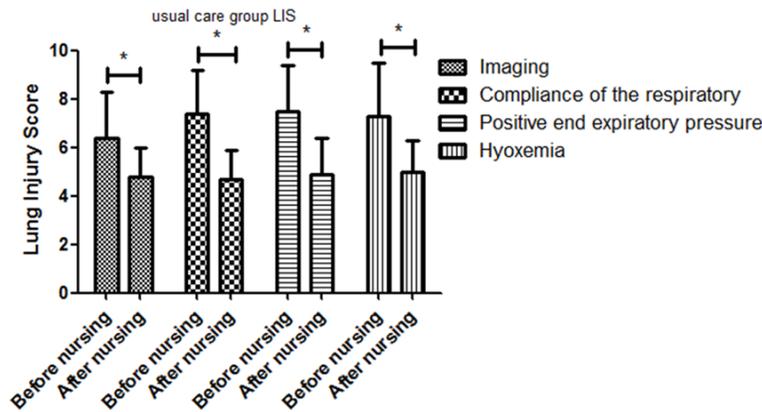


Figure 2. Comparison of LIS in the routine nursing group before and after nursing. LIS, lung injury scores. By comparing imaging examination ($t=6.603$), respiratory system compliance ($t=11.570$), positive end-expiratory pressure ($t=9.960$) and hypoxemia ($t=8.347$) before and after routine nursing, the difference was statistically significant ($*P=0.001$).

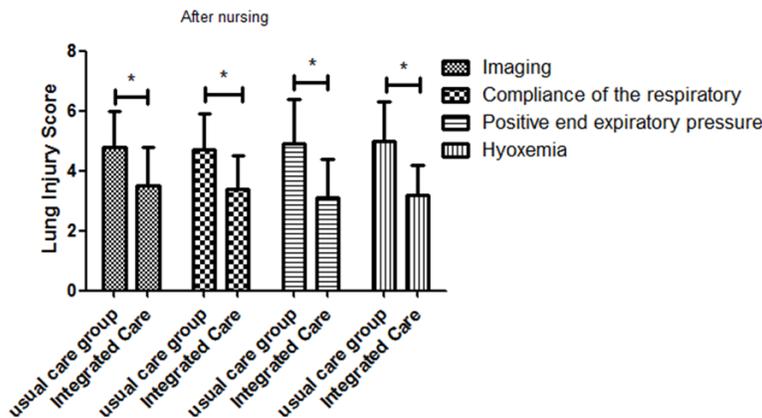


Figure 3. Comparison of LIS after nursing between the routine nursing group and the comprehensive nursing group. LIS, lung injury scores. By comparing imaging examination ($t=7.933$), respiratory system compliance ($t=8.915$), positive end-expiratory pressure ($t=10.240$) and hypoxemia ($t=12.710$) between the routine nursing group and the comprehensive nursing group after nursing, the difference was statistically significant ($*P=0.001$).

Observation indexes

Main outcome measures: Lung injury scores (LIS) were measured in both groups at 1 week before and after nursing in a total of four items (X-ray, hypoxemia, positive end-expiratory pressure, and respiratory system compliance). Each item was scored at 16 points [10]. Higher scores indicated more severe lung injury. Depression status of the two groups (after fully conscious) was observed using the self-rating depressive scale (SDS) [11]. Higher scores indicated more serious depression. Self-rating anxiety scale (SAS) was used to observe the anxiety of the two groups (after consciousness was

awake) [11]. Higher scores indicated more serious anxiety. Patient hospitalization time, gastrointestinal bleeding, infections, damage of liver and kidney function, and death of patients were registered and analyzed.

Secondary outcome measures: XN-L Series (Sysmex Corporation, Japan) was used to perform routine blood tests on the two groups of patients including platelet, white blood cell, and hemoglobin. Patients were rated on degree of satisfaction with the nursing process: very satisfied; satisfied; general; (satisfaction rate = very satisfied + satisfied/total number of patients * 100%) [12].

Statistical methods

SPSS20.0 statistical software was used for statistical analysis of all collected data and GraphPad Prism 5 was used to plot the analyzed data. Measurement data are expressed as mean \pm standard deviation ($\bar{x} \pm sd$) and detected by Student's t-test. Counting data are expressed as percentage (%), detected by Chi-square test. $P < 0.05$ indicates a statistical difference.

Results

Analysis of patient data

Through statistical analysis, it was found that there was no statistical significance in clinical data between the comprehensive nursing group and routine nursing group. (all $P > 0.05$) as shown in **Table 1**.

Comparison of LIS scores in the two groups of patients before and after nursing

Comparison of LIS scores, 1 week before and after nursing, showed that imaging tests, compliance of the respiratory system, positive end-expiratory pressure, and hypoxemia of the two

Effects of comprehensive nursing intervention in rescue of acute PQ poisoning

Table 2. Occurrence of adverse reactions after nursing care (n, %)

	Routine nursing group (n=86)	Comprehensive nursing group (n=200)	χ^2/t	P
Hospitalization time (d)	15.7±2.4	9.5±1.7	24.832	0.001
Gastrointestinal hemorrhage	48 (55.81)	80 (40.00)	6.083	0.014
Kidney function impairment	35 (40.70)	50 (25.00)	7.095	0.008
Infection	27 (31.40)	34 (17.00)	7.192	0.007
Death	12 (13.95)	15 (7.50)	4.188	0.040

Table 3. Patient satisfaction degree (n, %)

	Routine nursing group (n=86)	Comprehensive nursing group (n=200)	χ^2	P
Very satisfied	16 (18.60)	83 (41.50)	55.374	0.001
Satisfied	34 (39.53)	105 (52.50)		
General	36 (41.86)	12 (6.00)		
Satisfaction rate (%)	58.13	94.00		

ney function impairment, infection, and mortality rates of the comprehensive nursing group were significantly lower than the routine nursing group, with statistical significance (all $P < 0.05$) as shown in **Table 2**.

Table 4. SDS and SAS scores of the two groups (score)

	SDS	SAS
Routine nursing group		
Before nursing	58.5±6.2	55.8±4.3
After nursing	50.8±5.1*	39.4±4.8*
t	8.895	23.600
P	0.001	0.001
Comprehensive nursing group		
Before nursing	57.5±5.9	55.1±4.7
After nursing	42.6±3.5	32.8±4.2
t	30.717	50.033
P	0.001	0.001

Note: SDS, self-rating depressive scale; SAS, self-rating anxiety scale. Compared with the SDS and SAS scores of the comprehensive nursing group after nursing, * $P < 0.01$ ($t = 15.720$, $P = 0.001$; $t = 11.660$, $P = 0.001$, respectively).

groups of patients after nursing were significantly lower than before nursing, with statistical significance (all $P < 0.05$). LIS scores of the comprehensive nursing group after nursing were different from the routine nursing group, also with statistical significance ($P < 0.05$) as shown in **Figures 1-3**.

Incidence of adverse reactions after nursing in both groups

Statistical analysis of adverse effects of acute PQ poisoning hospitalization, observed by two different nursing methods, found that hospitalization time, gastrointestinal hemorrhage, kid-

Patient satisfaction

Through scoring the nurses, it was found that the satisfaction degree of patients in the routine nursing group was significantly lower than the comprehensive nursing group. Differences were statistically significant ($P < 0.05$) as shown in **Table 3**.

SDS and SAS scores of patients

Self-evaluation of the two groups of patients, with SDS scores and SAS scores, showed a significant difference between the routine nursing group and comprehensive nursing group compared with before nursing treatment (both $P < 0.01$). Comparison of SDS scores and SAS scores after nursing between the two groups showed that SDS scores and SAS scores of the comprehensive nursing group were significantly lower than the conventional nursing group. Differences were statistically significant (both $P < 0.01$) as shown in **Table 4**.

Discussion

PQ has been widely promoted in China because of its obvious herbicidal effects. It has been heavily used in grass-roots rural areas in China [13]. Due to its strong toxicity and high mortality and morbidity, the state gradually banned the sale of PQ in the marketplace. However, due to good herbicidal effects and no residual effects, it is still being sold in many places. With the rapid development of society, more and

Effects of comprehensive nursing intervention in rescue of acute PQ poisoning

more people have been dissatisfied with the society. Helplessness and weakness has caused patients to commit suicide with PQ. Statistics have shown that if PQ intake is greater than 20-40 mg/kg, patients will be prone to suffering from acute pulmonary hemorrhage, pulmonary edema, respiratory distress syndrome, severe hepatic and renal dysfunction, possibly leading to acute liver and renal failure [14-16]. In addition, studies have shown that PQ poisoning may affect the body's oxidation and inflammatory mechanisms, as well as apoptosis and DNA damage. However, its influence on body organs involves many aspects and specific mechanisms of PQ poisoning remain unclear [17-19].

This present study has played a certain role in improvement of patient conditions by comprehensive nursing intervention. Clinical comprehensive nursing is a comprehensive nursing method composed of nursing care on psychological state, breathing state, liver and kidney function, diet, and adverse drug reactions. All of these are beneficial for patient recovery [20]. PQ poisoning patients have generally been those attempting suicide. Most patients had interpersonal and emotional disorders with pre-admission psychological emotional instability and strong suicidal tendencies after admission. However, after patients are rescued from life-threatening danger, they may develop emotions such as fear and regret. Generation of multiple emotions may lead to more serious consequences if patients are not consoled and communicated with properly. Therefore, psychological care was added during the process of treatment to help patients with psychological counseling and timely communication, hopefully reducing or improving the occurrence of negative emotions [21]. PQ intake has effects on the upper digestive tract and additional nutritional supplements are required promptly. Effects on lung function are irreversible and may lead to interstitial hyperplasia of the lungs, resulting in a large amount of matrix protein secretion. This, in turn, causes pulmonary fibrosis leading to respiratory failure [22]. Liver and kidney function impairment also serves as a complication of PQ intake. The kidneys are the most important excretion organs in the human body. PQ will lead to glomerular injury after staying in the kidneys for a long time. Nevertheless, hepatic injury may also cause

decrease of blood pressure, abdominal pain and distention, and shock. Therefore, monitoring of liver and kidney function could reduce the degree of damage in patients [23]. Clinical medication treatment of PQ poisoning patients has generally been glucocorticoids and cyclophosphamide. These types of drugs have a good effect in the treatment of lung injuries but also produce a variety of adverse reactions. Incidence of adverse reactions can be avoided or reduced by nursing these patient adverse reactions [24].

This research compared LIS scores of the two groups of patients, finding that LIS scores after nursing treatment in both comprehensive nursing group and routine nursing group were lower than those before treatment, with statistically significant differences. Furthermore, LIS scores of the two groups after nursing treatment showed that LIS scores of the comprehensive nursing group were lower than the routine nursing group, with statistical differences between the two groups. This can also explain the reduction in lung damage of patients that have undergone comprehensive nursing. Statistical analysis of patient adverse reactions found that incidence of adverse reactions in the comprehensive nursing group was significantly lower than in the routine nursing group, indicating that comprehensive care could effectively reduce occurrence of adverse reactions in patients. At the end of this research, patient satisfaction rating, SAS scores, and SDS scores were conducted. It was found that patient satisfaction rates in the comprehensive nursing group were significantly higher than the routine nursing group and SAS scores and SDS scores in the comprehensive nursing group were significantly lower than the routine nursing group. Through the above research, it can be seen that nursing effects of the comprehensive nursing group in acute PQ poisoning were significantly higher than that of the routine nursing group. This is basically consistent with results reported by Yan et al. [25]. Mortality of patients, however, is much different from that of this research, possibly due to the different number of samples taken in and difference of PQ intake.

However, there are still some limitations to this present stud. First, whether the uneven distribution of samples was biased against this result is unknown. Second, the differences in

Effects of comprehensive nursing intervention in rescue of acute PQ poisoning

concentration of PQ taken by patients are not clear. Therefore, large numbers of samples should be collected in future studies to ensure the accuracy of the present experiment.

In summary, comprehensive nursing could effectively reduce the degree of lung injury in patients with PQ poisoning, shorten the time of hospitalization, and reduce the incidence of infection and death.

Disclosure of conflict of interest

None.

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Effects of comprehensive nursing intervention in rescue of acute PQ poisoning

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