Application of fine nursing in the drug resistance of Klebsiella pneumoniae and its influence on immune function

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[Abstract] Objective To explore the application of meticulous nursing in the drug resistance of Klebsiella pneumoniae (KPN) in children and its effect on immune function. Methods 100 children with KPN infection in our hospital from January 2020 to January 2021 were selected and randomly divided into the control group (50 cases) and the observation group (50 cases). The control group was given routine nursing, while the observation group was given fine nursing on the basis of the control group for 2 weeks. The clinical efficacy, KPN resistance, CD4 +, CD8 +, CD4 + / CD8 +, IgA, IgG, IgM levels and satisfaction were compared between the two groups. Results Compared with the control group (72.00%), the total clinical effective rate of the observation group (90.00%) was significantly increased, the difference was statistically significant ($P < 0.05$). The drug resistance of the observation group to a variety of antimicrobial agents was significantly higher than that of the control group, the difference was statistically significant ($P < 0.05$). Compared with before nursing, CD4 +, CD4 + / CD8 + were significantly increased, CD8 +, IgA, IgG, IgM were significantly decreased, the difference was statistically significant ($P < 0.05$). Compared with the control group (76.00%), the nursing satisfaction of the observation group was significantly higher ($P < 0.05$). Conclusion Fine nursing not only has a good application effect in children with KPN resistance, but also can significantly improve the immune function of children, which is worthy of clinical reference.
[Key words] Fine nursing; Klebsiella pneumoniae; drug resistance; immune function

Klebsiella pneumoniae (KPN), as a gram-negative bacillus, is a major pathogen causing hospital and community infections, and it is easy to invade the lungs of the body, and then cause pneumonia, which seriously threatens human health and quality of life [1]. Because children's body functions are not fully developed and their resistance and defense are low, they are more susceptible to KPN [2]. Relevant research shows that with the wide use of antibacterial drugs in

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clinic, KPN has gradually developed inherent drug resistance and multiple drug resistance to different antibacterial drugs in a wide range, increasing the difficulty of clinical treatment [3], so it should be paid great attention to clinically. Some scholars have found that active and effective nursing intervention is of great significance to block the prevalence of pathogenic bacteria [4]. At present, the clinical practice mainly carries out routine nursing on children and their families in medication, diet, health knowledge education and other aspects. Although certain results have been achieved, the clinical expected effect has not yet been achieved [5], so other more efficient nursing methods need to be found. As a modern intervention mode, fine nursing involving medication nursing, diet guidance, basic nursing and other links, can effectively avoid nursing loopholes and blind nursing, which is of great significance for improving nursing effect and quality [6]. At present, fine nursing has been clinically used in the nursing of various inflammatory reaction diseases, which has achieved remarkable application results [7, 8], but there are few studies on its application in children's KPN drug resistance, which is worthy of further study. Therefore, this study was mainly to explore the application effect of intensive washing nursing in children's KPN resistance and its influence on immune function, aiming at providing some scientific reference for clinical avoidance of KPN resistance.

1 Data and Methods

1.1 General data

100 children with KPN infection who visited our hospital from January 2020 to January 2021 were selected as research objects, and were divided into control group (50 cases) and observation group (50 cases) according to random number table method. The control group was given routine nursing, while the observation group was given fine nursing on the basis of the control group. Control group: 29 males and 21 females. The age ranged from 2 to 12 years old, with an average of (7.24 ± 1.03) years old. The course of disease ranged from 1 to 9 days, with an average of (4.26 ± 0.35) days. Body mass index (BMI) ranged from 14.54 to 19.25 kg/m^2, with an average of (15.94 ± 1.23) kg/m^2. Infection sites: oral cavity in 2 cases, urinary tract in 3 cases, thoracic and abdominal cavity in 4 cases, blood in 6 cases and lower respiratory tract in 35 cases. Observation group: 28 males and 22 females; The age ranged from 1 to 12 years old, with an average of (7.36 1.08) years old. The course of disease ranged from 1 to 9 days, with an average of (4.30 ± 0.41) days. BMI 14.16 ~ 19.08 kg/m^2, with an average of (15.32 ± 1.25) kg/m^2. Infection sites: oral cavity in 3 cases, urinary tract in 3 cases, thoracic and abdominal cavity in 5 cases, blood in 5 cases and lower respiratory tract in 34 cases. There was no significant difference in gender, age, course of disease, BMI and infection site between the two groups ($P > 0.05$).

1.2 Inclusion and exclusion criteria

Inclusion criteria: ① According to the diagnostic criteria of KPN in Diagnostic Criteria for Nosocomial Infection (Trial) [9], all children were diagnosed as KPN infection. ② Age $\leq$ 12 years old. (3) The family members of the children signed an informed consent form.

Exclusion criteria: ① Children who have received relevant nursing care. ② Children with KPN resistance. ③ Children with other infections or inflammatory diseases. ④ Children with extremely low clinical compliance.

1.3 Methods

The control group received routine nursing: the children were given health education after admission, their vital signs were monitored, their clinical manifestations were observed, and their standardized medication was guided. At the same time, they were given certain environmental management, nursing of infected parts, diet intervention, psychological counseling, etc.

The observation group received fine nursing on the basis of the control group: ① Strictly implement the aseptic concept: carefully abide by the operating procedures in various nursing, wash hands correctly before and after each operation, and seriously implement the disinfection and isolation system and aseptic technology. Keep the ward at a suitable temperature and keep it clean, tidy and ventilated. Isolate the children according to their infected parts, mark the isolation on the bedside card, and guide the family members to implement it. For children with abnormal leukopenia, protective isolation or single room isolation shall be implemented. Family members are told to seriously implement the visiting system, wash their hands strictly before and after contacting children, and at the same time, contact other family members and patients as little as possible. In addition, the number of visits is limited to some extent. (2) Basic nursing: Before infusion therapy, three checks and seven pairs must be made to avoid importing deteriorated and expired drugs into children's bodies. Do not puncture the infected site, and do a good job in skin and oral care. (3) Monitoring infection signs: Observe and record the body temperature and heat type of children, and determine the time and frequency of body temperature detection according to their condition. Monitor the changes of pharynx, oral cavity and other parts of children, observe whether there is thrush, stomatitis and flaky white film, report to doctors in time, and give targeted treatment. Check whether the child has signs of respiratory tract infection, such as lung rales, expectoration, cough, etc. Observe whether diarrhea, abdominal pain and other symptoms occur, and observe the character, quantity and color of defense at the same time; Take samples of secretions, sputum, stool, urine, blood and other samples of children and send them for inspection, so as to ensure their correctness during sampling. ④ Nursing of respiratory tract: strengthen ward management to keep ward air fresh, indoor clean and ventilated. For children with sputum, we should try our best to promote the excretion of sputum, which can be promoted by knocking on the back and turning over. Strictly disinfect pipelines, oxygen humidification bottles, etc., and dry and store them. For the oxygen humidification bottle used, insist on disinfection and replacement twice a week, and the distilled water in the bottle is replaced daily. Insist on using a disposable atomizer for one person, and discard the atomized liquid that has not been used up for 24 hours. The ventilator pipeline used should be replaced regularly, and the pipeline should be humidified and atomized with sterile liquid. ⑤ Dietary intervention: For children who can eat, they should

be given foods that are easy to digest, rich in nutrition, high in calories, high in vitamins and high in protein, and encourage them to eat more fresh fruits. For children who cannot eat, nutritional support is given. Try to avoid the use of immunosuppressants, and use certain immunomodulators such as interleukins and interferons when necessary to correct anemia and malnutrition. ⑥ Medication guidance: strictly control the administration time of antibacterial drugs. Reasonable compatibility of drugs. Close observation of side effects and toxic side effects of antibacterial drugs. In strict accordance with the results of drug sensitivity test, sensitive antibacterial drugs were selected to treat children.

Both groups were given continuous nursing for 2 weeks.

1.4 Observation indexes

① Clinical efficacy: markedly effective: cough, wheezing, chest tightness, cough, fever and other symptoms basically or completely disappeared, and there was no obvious dry and wet rale in the lungs. Effective: Cough, wheezing, chest tightness, cough, fever and other symptoms have been improved, and dry and wet rales in the lungs have been relieved but not disappeared; Ineffective: cough, wheezing, chest tightness, cough, fever and other symptoms have not improved or even deteriorated significantly, and the dry and wet rales in the lungs are large; Clinical total effective = (markedly effective + effective) [10]. ② Results of KPN drug sensitivity analysis: Kirby-bauer (K-B) method was used for drug sensitivity test. The experimental operation was strictly carried out according to the instructions of drug sensitivity paper. The judgment standard was based on the standards of the Comparison of Clinical and Laboratory Standards Institute (CLSI) [11]. The culture medium and drug sensitivity paper used were provided by Shanghai Yibaiju Economic and Trade Co., Ltd. ③ Immune function: One day before nursing and two weeks after nursing, 5 mL of fasting elbow venous blood of children was taken and placed in EP tube. After standing at normal temperature for 1 h, serum was separated by centrifugation and stored at minus 25 ℃ for test. The levels of CD4 +, CD8 +, CD4+/CD8 + were detected by flow cytometry (American BD Company, model: FACS Canto Ⅱ). Immunoglobulin A (IgA), Immunoglobulin G (IgG) and Immunoglobulin M (IgM) levels were detected by rate nephelometry. The kit used was provided by Shanghai Blue Biotechnology Co., Ltd.. ④ Satisfaction: The hospital self-made scale was used to investigate the family members' satisfaction with nursing, which was divided into very satisfied, satisfied and dissatisfied. Total Satisfaction = Very Satisfied + Satisfied.

1.5 Statistical methods

SPSS 18.0 was used for statistical analysis, the measurement data were expressed as mean $\pm$ standard deviation ($\bar{x}\pm$ s), and t test was done. The counting data were expressed as cases (n) or percentage (%), and χ^2 was performed. $P < 0.05$ indicated that the difference was statistically significant.

2 Results

2.1 Comparison of clinical efficacy between the two groups

The total clinical effective rate of the observation group (90.00%) was significantly higher than that of the control group (72.00%), and the difference was statistically significant (t=6.538, P=0. 016), see figure 1.
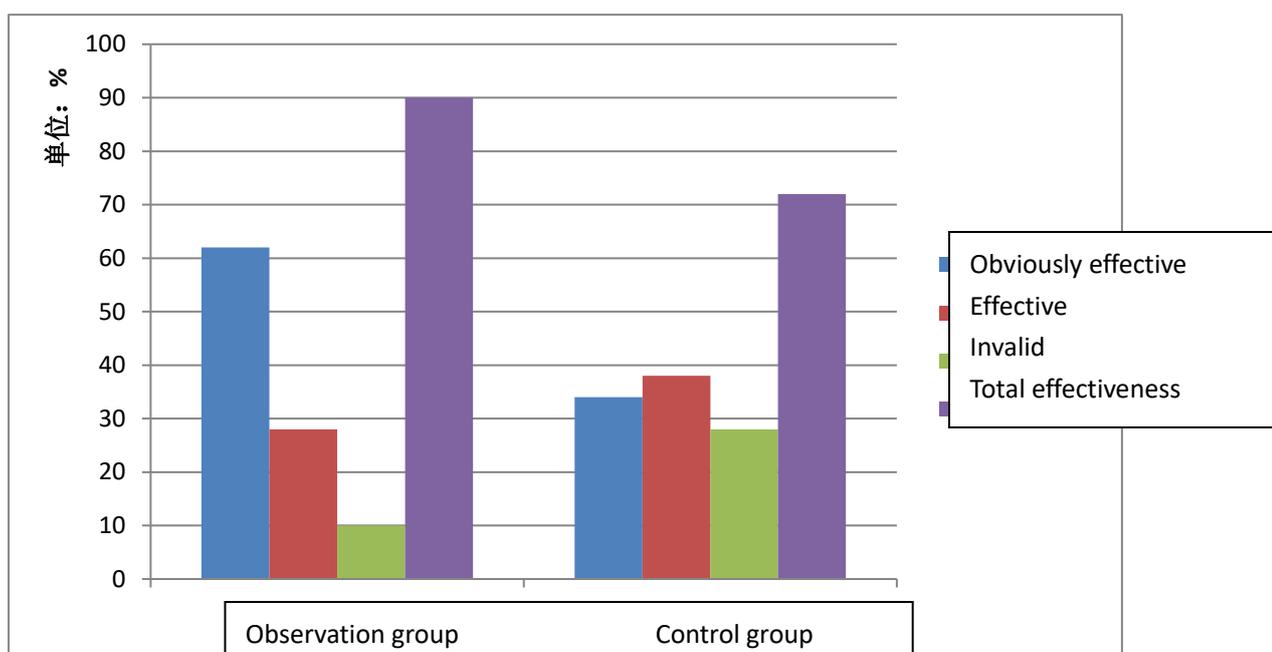
Fig. 1 Comparison of clinical efficacy between the two groups

2.2 Comparison of drug sensitivity analysis results of KPN between two groups

There were no significant differences in drug resistance between the two groups to amikacin, aztreonam, nitrofurantoin, compound sulfamethoxazole, piperacillin/tazobactam, cefepime, cefoperazone/sulbactam, ceftriaxone, cefoxitin, cefazolin, tobramycin, and imipenem ($P > 0.05$). The drug resistance of the observation group to amoxicillin/clavulanic acid, ampicillin, ciprofloxacin, gentamicin and levofloxacin was significantly lower than that of the control group ($P < 0.05$), see table 1 and figure 2.

Table 1 Comparison of KPN susceptibility analysis results between the two groups [n (%)]

Antibacterial drugs	Observation group (n=50)	Control group (n=50)	χ^2	P value
Amikacin	2(4.00)	3(6.00)	0.698	0.704
Amoxicillin/clavulanic acid	9(18.00)	13(26.00)	7.162	0.008
Ampicillin	47(94.00)	50(100.00)	6.961	0.011
Aztreonam	14(28.00)	16(32.00)	2.588	0.272

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Nitrofurantoin	13(26.00)	14(28.00)	1.261	0.493
Compound sulfamethoxazole	18(36.00)	22(44.00)	1.194	0.550
Ciprofloxacin	10(20.00)	15(30.00)	7.592	0.005
Piperacillin/tazobactam	3(6.00)	3(6.00)	0.000	1.000
Gentamicin	12(24.00)	16(32.00)	7.014	0.010
Cefepime	7(14.00)	9(18.00)	3.820	0.147
Cefoperazone/sulbactam	0(0.00)	0(0.00)	0.000	1.000
Ceftriaxone	0(0.00)	0(0.00)	0.000	1.000
Cefoxitin	10(20.00)	9(18.00)	1.464	0.480
Cefazolin	22(44.00)	24(48.00)	3.730	0.154
Tobramycin	6(12.00)	7(14.00)	0.822	0.663
Imipenem	2(4.00)	3(6.00)	0.257	0.879
Levofloxacin	7(14.00)	10(20.00)	6.623	0.012
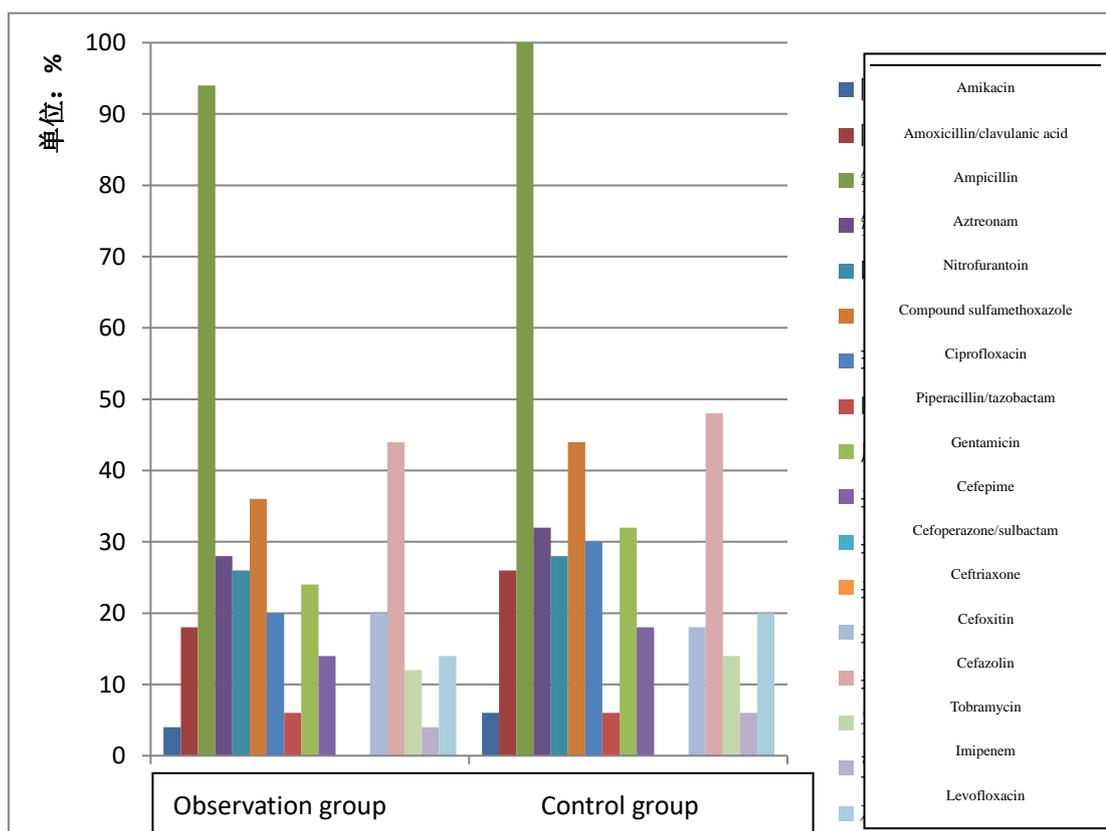
Fig. 2 Comparison of KPN susceptibility analysis results between the two groups

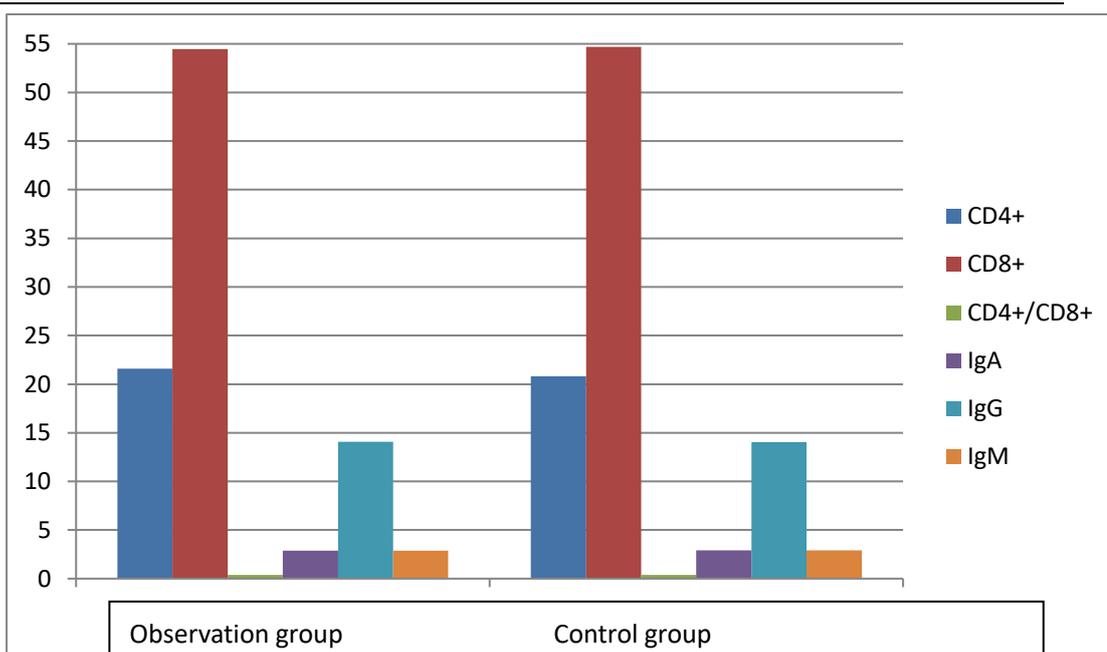**2.3 Comparison of immune function between two groups before and after nursing**

Before nursing, there was no significant difference in CD4 +, CD8 +, CD4+/CD8 +, IgA, IgG and IgM between the two groups (P > 0.05). After nursing, CD4 +, CD4+/CD8 + in the two groups increased significantly, while CD8 +, IgA, IgG, IgM decreased significantly. The change

range of the observation group was significantly greater than that of the control group, and the difference was statistically significant ($P < 0.05$). See Table 2, Figure 3, Figure 4.
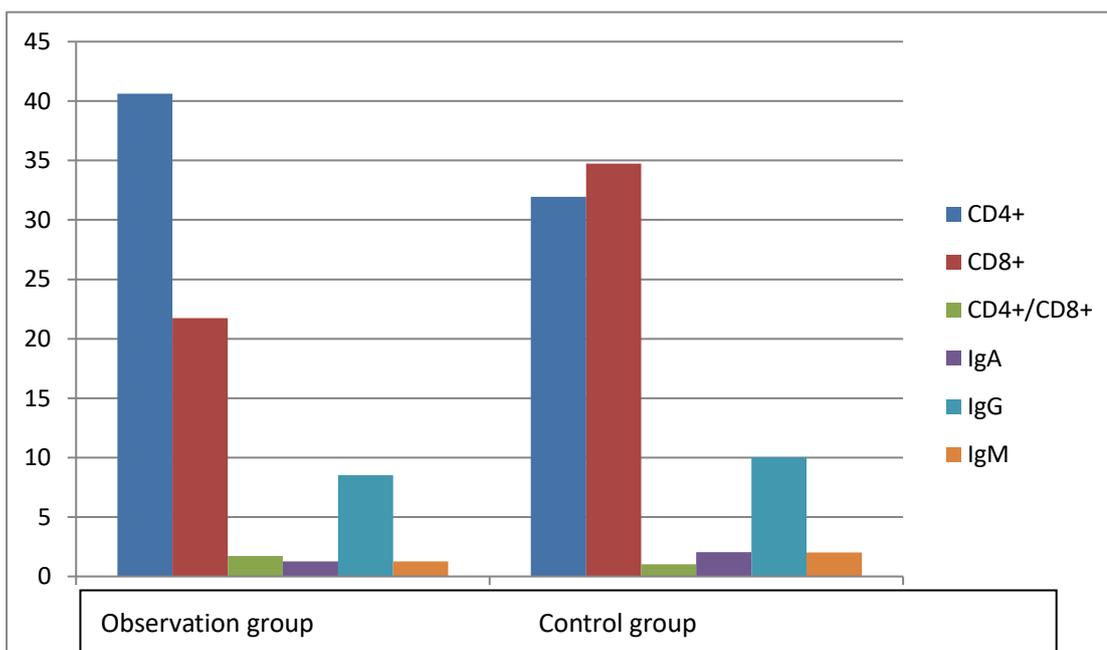
Table 2 Comparison of immune function between two groups before and after nursing($\bar{x}$ ±s)

Indicators		Observation group (n=50)	Control group (n=50)	t	P value
CD4+(%)	Before nursing	21.60±4.25	20.82±4.16	0.767	0.772
	After nursing	40.62±2.43*	31.95±1.42*	7.014	0.010
CD8+(%)	Before nursing	54.46±4.28	54.68±4.33	0.846	0.569
	After nursing	21.73±3.66*	34.74±2.96*	7.527	0.002
CD4+/CD8+	Before nursing	0.38±0.03	0.39±0.02	0.931	0.472
	After nursing	1.72±0.10*	1.02±0.08*	5.421	0.041
IgA(g/L)	Before nursing	2.88±0.49	2.90±0.46	0.839	0.584
	After nursing	1.26±0.19*	2.04±0.28*	5.471	0.033
IgG(g/L)	Before nursing	14.06±1.49	14.03±1.44	0.917	0.482
	After nursing	8.52±0.52*	10.02±0.96*	6.518	0.020
IgM(g/L)	Before nursing	2.89±0.56	2.92±0.58	0.756	0.779
	After nursing	1.28±0.33*	2.01±0.46*	5.469	0.034

Note: * indicates the comparison between the same group before and after nursing, * $P < 0.05$.

Fig. 3 Comparison of immune function between two groups before nursing

Fig. 4 Comparison of immune function between two groups after nursing

2.4 Comparison of nursing satisfaction between two groups

The nursing satisfaction of the observation group (94.00%) was significantly higher than that of the control group (76.00%), and the difference was statistically significant (t=6.661, P=0. 015). See figure 5.
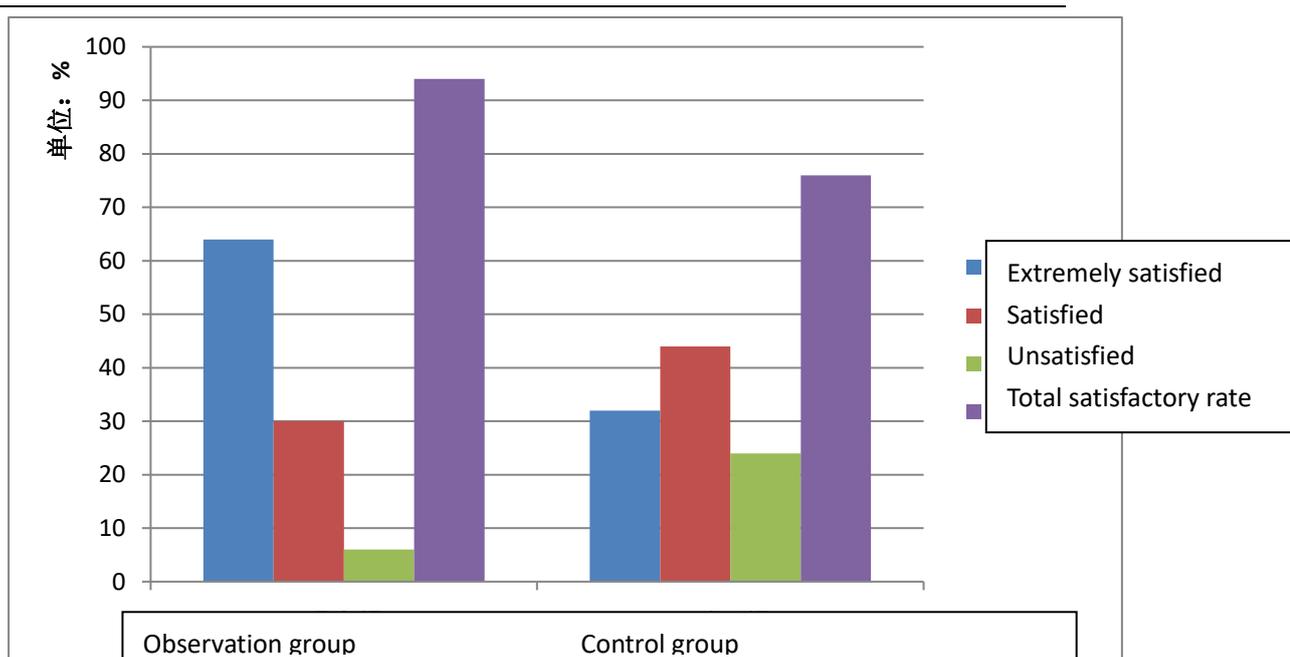
3 Discussion

KPN mainly resides in the intestinal tract and upper respiratory tract of the body, and can invade the body through catheters, atomizers, etc. In addition, KPN is resistant to various antibacterial drugs, resulting in unsatisfactory prognosis quality of patients and even death [12]. At present, the drug resistance of KPN is mostly reduced by rational use of antibacterial drugs, but it is far from meeting the clinical needs. However, fine nursing pursues excellence and improves the overall service quality through detailed service, accurate operation and avoidance of deviation and error [13]. When detailed and fine nursing is applied to clinical practice, the specific situation of patients is analyzed concretely, and personalized and targeted high-quality nursing services are provided for patients through comprehensive evaluation of possible risks, which has been unanimously recognized by clinicians and patients [14]. However, there are few studies to explore the application of fine nursing in children with KPN resistance and its influence on immune function.

Hu Meihao [15] show that after fine nursing, the clinical efficacy of patients is significantly increased. In this study, the total clinical effective rate of the observation group is significantly higher than that of the control group, which is basically consistent with the results of Hu Meihao's study. In addition, the results of this study also show that compared with the control group, the drug resistance of the observation group to various antibacterial drugs is significantly reduced, indicating that fine nursing can not only effectively improve the clinical efficacy of children with KPN infection, but also reduce the drug resistance of KPN. Fine nursing is a complete, detailed and specific solitary sail nursing method based on comprehensiveness, practicality and professionalism. It revolves around patients and runs through the whole medical process, including nutrition, clinical pharmacy, nursing, basic medicine and other contents [16]. Fine

nursing is applied to children with KPN infection. It provides targeted nursing for the environment, infection signs, respiratory tract, diet, medication and other aspects of the children, which can effectively avoid cross infection of the children, and is of great significance for improving clinical efficacy. In addition, according to the results of drug sensitivity test, antibacterial drugs with higher sensitivity was selected to treat children, which can not only effectively improve the clinical efficacy, but also reduce the incidence of drug resistance.

Decreased immune function is one of the main causes of infection, so enhancing the body's immune function plays a key role in clinical treatment of infection [17]. Body immunity can be divided into cellular immunity and humoral immunity. Cellular immunity mainly comes from T lymphocytes. CD4 + can play an auxiliary role in the immunity of the body. CD8 + can inhibit the metastasis, diffusion and growth of tumor cells. CD4+/CD8 + can reflect the immune situation of the body and maintain a dynamic balance state in the middle stage of the normal body. Once decreased, it indicates that the cellular immune function is reduced [18]. Immunoglobulin is one of the commonly used detection methods for the body's humoral immune function. When the levels of immunoglobulin IgA, IgG and IgM are found to be abnormally elevated, the body's humoral immune deficiency can be determined [19]. Wang Xiaoling et al. [20] shows that the cellular immunity and humoral immunity of patients are obviously improved after meticulous nursing in nursing management. Xu Hong et al. [21] show that the levels of IgA, IgG and IgM of patients are significantly reduced after careful nursing. In this study, after nursing, CD4 +, CD4+/CD8 + in the two groups increased, CD8 +, IgA, IgG, IgM decreased, but compared with the control group, the change in the observation group was more significant, which was basically consistent with the research results of Wang Xiaoling and Xu Hong, indicating that fine nursing can effectively improve the immune function of children with KPN infection. The possible causes were analyzed: Fine nursing requires the participation of patients, doctors and nurses, which embodies multidisciplinary contents in clinical treatment and nursing. On the one hand, health education on diet has attracted great attention from the families of the children. On the other hand, it has directly intervened in the diet of the children, which help children eating foods with high protein, high calorie and rich vitamin C, thus correcting anemia, malnutrition and other problems of the children through immunomodulators when necessary.

Dong Yang [22] shows that compared with traditional nursing, refined nursing is conducive to improving patients' nursing satisfaction. In this study, the nursing satisfaction of the observation group is obviously higher than that of the control group, which is completely consistent with the results of Dong Yan's study, indicating that the application of fine nursing in children with KPN resistance can also improve the nursing satisfaction. Fine nursing is patient-centered. According to the specific situation of patients, it comprehensively considers their needs and implements them, which not only makes patients feel concerned, but also cares for patients' disease management, daily life, diet, etc. Fine nursing effectively improves the quality of clinical nursing, and then

creates a good doctor-patient relationship, which is conducive to the development of clinical treatment and nursing.

To sum up, the application of fine nursing in children with KPN infection can not only improve their clinical efficacy, reduce KPN drug resistance and improve immune function, but also improve nursing satisfaction, which has high clinical reference value.

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