Biomedical Research 2017; 28 (21): 9429-9433 *ISSN 0970-938X*
www.biomedres.info

Risk factors and prevention counter measures of nosocomial infection in hospitalized children.

Xiuzhen Zhao[1*], Li Feng[2], Ju Wang[3], Hui Zhao[1], Sumin Zhao[4]

[1]Department of Pediatrics, Zhangqiu People's Hospital, Jinan, Shandong, PR China

[2]Department of Obstetrics, Zhangqiu People's Hospital, Jinan, Shandong, PR China

[3]Facial Features Two Families, Zhangqiu People's Hospital, Jinan, Shandong, PR China

[4]Neonatal Ward, Zhangqiu People's Hospital, Jinan, Shandong, PR China

Abstract

Objective: To improve the quality of clinical treatment by investigating the risk factors and explore prevention countermeasures of nosocomial infection in hospitalized children.
Methods: From February 2015 to April 2017, a total of 1526 hospitalized kids enrolled in the Pediatrics Center of our hospital were selected as the objects. The clinical data, admission situation and treatment status of children with nosocomial infection were analysed, the risk factors of nosocomial infection in hospitalized children were studied through single factor analysis and multivariate logistic analysis followed by the discussion on the prevention and control measures.
Results: There were 54 cases of nosocomial infection in 1526 children with the infection rate as 3.53%. The results of single factor analysis and multivariate logistic analysis showed that the independent risk factors of nosocomial infection included the kid's age under 3 y old, poor nutrition, suffering from infection at admission, hospitalization time over 5 d, the type of used anti-infective agents more than 3, hormone use and invasive operation.
Conclusion: There are many risk factors of nosocomial infection in hospitalized children, which requires strengthening monitor, including the development of various effective prevention measures and check of their implementation as well as effectiveness, to reduce the incidence of hospital infection.

Keywords: Pediatrics Center, Nosocomial infection, Risk factors, Prevention measures.

Accepted on November 29, 2017

Introduction

Ward infection is a prominent problem in clinic works today and has attracted much attention in recent years. Control of nosocomial infection rate is an important indicator to measure the quality of medical care [1]. Children's immune system is not totally mature, organ function is relatively weak, body resistance is low and capability of adapting to the external environment is poor. Besides, hospital is a place to congregate various pathogens. In the process of treatment, there may be some defects in all kinds of operations such as puncture, intubation and disinfection, all of that can increase the risk of pathogen invasion and infection and thus result in high incidence of nosocomial infection [2-4]. Hospital infection brings great burden to children both physiologically and psychologically, which increases economic pressure of children's family as well. The most important concept of hospital infection management is that prevention is better than cure, and effective prevention can reduce the infection rate, improve the quality of treatment and decrease patients' physical and psychological suffering [5-7]. The prevention measures of nosocomial infection are developed on the premise of understanding its causes and risk factors. The measures for different level of prevention and control are put forward to improve the purpose and pertinence, thus giving rise to good effects of hospital infection prevention. There are some reports on hospital infection in domestic Women-Children Special Hospital and Pediatric Wards of General Hospital [8,9], but the research into risk factors is not specific or comprehensive enough. To make better prevention of the hospital infection in pediatric wards and to lay foundation for making control measures, a retrospective analysis was conducted in the study on the clinical data of children hospitalized in recent years, the risk factors of nosocomial infection were explored, and the prevention and control measures for reducing the infection rate was analysed so that the quality of treatment could be improved.

Materials and Methods

Clinical data

From February 2015 to April 2017, 1526 children hospitalized in our hospital were selected as the objects, consisting of 892 males and 634 females aged from 5 months to 10 y with an average age of 5.6 ± 0.3 y. All children had been physically healthy with the exclusion of those with immune system diseases or other serious systemic diseases and those who did not cooperate with the treatment.

Research methods

Retrospective analysis was conducted on the children's various data like general information (name, gender, age, nutrition status, etc.) admission situation (the diagnosis, with or without infectious diseases at admission) and treatment status (total duration, hospitalization time, the use of antibacterial drugs, with or without invasive operation and the level of hemoglobin), and the sites of nosocomial infection were recorded and analysed.

Statistical analysis

The data were analysed by SPSS 21.0, the counting data were assessed by Chi-square test with the logistic regression used for multivariate analysis, $P<0.05$ suggests that the difference is statistically significant.

Results

Infection rate

A total of 54 from 1526 children had nosocomial infection, accounting for 3.53%. Among the 54 cases, there were 16 cases with upper respiratory tract infection, 15 with gastrointestinal tract infection, 12 with lower respiratory tract infection, 3 with urinary tract infection, 5 with blood system infection and 3 with other infection (Table 1).

Table 1. *Type and constituent ratio of nosocomial infection in children.*

Type of nosocomial infection	Cases	Constituent ratio
Upper respiratory tract infection	16	29.63
Gastrointestinal tract infection	15	27.77
Lower respiratory tract infection	12	22.22
Urinary tract infection	3	5.56
Blood system infection	5	9.26
Other infection	3	5.56
Total	54	100.00

Single factor analysis of nosocomial infection

The results of single factor analysis and multivariate logistic analysis showed that the related risk factors of nosocomial infection included the kid's age under 3 years old, poor nutrition, suffering from infection at admission, hospitalization time over 5 d, the type of used anti-infective agents more than 3, the duration of anti-infective agents use over 3 d, hormone use and invasive operation (Table 2).

Table 2. *Single factor analysis and rate of nosocomial infection in hospitalized children.*

Index	Survey cases	Infection cases	Infection rate	χ^2	P
Age				7.257	0.01
<3	520	24	4.62		
≥ 3	1006	30	2.98		
Gender				0.07	0.317
Male	892	29	3.25		
Female	634	25	3.94		
Nutrition state				5.362	0.021
Poor	500	27	5.4		
Moderate	515	20	3.88		
Good	511	7	1.37		
Infection at admission				7.105	0.009
Yes	750	40	5.33		

No	776	14	1.8		
Hospitalization time				5.846	0.019
≤ 5	960	18	1.88		
>5	566	36	6.36		
The type of used anti-infective agents				6.902	0.017
<3	1059	13	1.23		
≥ 3	467	41	8.78		
Hormone use					
Yes	178	25	14.04	9.361	0.006
No	1348	29	2.15		
Invasive operation				9.702	0.005
Yes	92	20	21.74		
No	1434	34	2.37		
Intensive care				9.005	0.009
Yes	85	18	21.18		
No	1441	36	2.5		
Duration of anti-infective agents use				6.043	0.02
≤ 3	789	17	2.15		
>3	737	37	5.02		

Multivariate logistic regression analysis of nosocomial infection

The results of multivariate logistic regression analysis showed that the independent risk factors of nosocomial infection included the kid's age under 3 y old, poor nutrition, with infection at admission, hospitalization time over 5 d, the type of used anti-infective agents more than 3, the duration of anti-infective agents use, hormone use and invasive operation (Table 3).

Table 3. *Multivariate logistic regression analysis of nosocomial infection in hospitalized children.*

Variable	β	SE	Wald χ^2	OR (95% CI)	P
Age<3 y old	0.752	0.334	4.376	1.477 (2.812-9.695)	0.031
Poor nutrition	1.017	0.474	18.164	1.281 (2.481-12.902)	0.037
With infection at admission	2.904	0.216	48.108	4.672 (2.178-21.033)	0.022
Hospitalization time>5 d	0.947	0.545	1.615	1.683 (1.073-2.452)	0.026
Type of applied antibacterial drugs ≥ 3	0.775	0.738	14.021	3.796 (1.893-8.972)	0.030
Duration of anti-infective agents use>3 d	0.679	0.635	12.094	1.754 (2.269-19.493)	0.019
Hormone use during treatment	1.402	0.358	17.105	1.833 (3.154-22.076)	0.026
Invasive operation	1.276	0.801	15.469	1.766 (2.716-18.103)	0.011

Discussion

Child patients on the pediatrics department are still in the development stage and have not yet established good immune function, coupled with the impact of basic diseases, their resistance can further decline, thus prone to hospital infection [10,11]. Furthermore, patients admitted to the department of pediatrics were children with varying diseases, especially the patients with infection of respiratory tract, which increases the probability of cross infection [12]. In this study, a total of 54 from 1526 children had nosocomial infection, accounting for 3.53% and among them there were 16 cases with upper

respiratory tract infection, 15 with gastrointestinal tract infection, 12 with lower respiratory tract infection, 3 with urinary tract infection, 5 with blood system infection and 3 with other infection. The statistics of patients' data showed that the related risk factors of nosocomial infection included the kid's age under 3 y old, poor nutrition, suffering from infection at admission, hospitalization time over 5 d, the type of used anti-infective agents more than 3, hormone use and invasive operation.

According to the risk factors of nosocomial infection in pediatric ward found through the investigation, we believe that the prevention and control of infection can be carried out from the several aspects. For example, the younger children with incomplete development of immune system are prone to infection because it is hard for them to make effective immune response when pathogenic bacteria invade. Poor nutrition and long-term use of hormones can also lower body immunity and then raise the risk of infection. Hospitalized children are treated with nutritional counselling and vitamin supplementation on a bland diet, when necessary drugs or biological agents can be adopted to enhance body immunity, all of which play an important role in prevention of the infection [13]. Additionally, antibacterial drug is effective in treatment and prevention of infection, but with its more and more unreasonable application, drug resistant strains are constantly increasing, and the use of antibacterial drugs is also upgrading, thus forming a vicious spiral. Some diseases caused by unknown pathogens are often blindly treated by antibacterial drugs, the type of which is frequently changed when the effect of previous treatment is not obvious [14]. In this study, the unreasonable use of antibiotics is also one of risk factors leading to nosocomial infection, if there is infection of patients at admission, pathogenic microorganisms should be identified as soon as possible followed by antimicrobial susceptibility test, and the patients should be given sensitive antimicrobial and reasonable treatment in time; in children without infection at admission, it is required to reduce unnecessary prophylactic use of antimicrobial agents, particularly for child patients without obvious symptoms of infection, broad-spectrum antibiotics should be avoided [15].

Moreover, invasive operations like intubation during the treatment can cause damages to the patient's respiratory tract mucosa and digestive tract mucosa, thus increasing the chance of infection, as a result the operation should be gently carried out under sterile conditions in strict accordance with norms to reduce mucosal injury. Along with the prolonging of hospitalization duration, the time of patients' exposing to high risk environment is also prolonged, so it contributes to nosocomial infection as well. In view of this, the hospitalization time of patients should be shortened on the one hand and on the other hand cleaning and disinfection of working environment should be ensured, the air, ground and surface of materials are required to be disinfected on a regular basis, each clothing and bedding as well as towel was disinfected after patient's use.

In summary, there are many risk factors of nosocomial infection in hospitalized children on the Pediatrics Department, which requires strengthening monitoring including the development of various effective prevention measures and check of their implementation as well as effectiveness, to reduce the incidence of hospital infection.

References

1. Ghassemi A, Farhangi H, Badiee Z. Evaluation of nosocomial infection in patients at hematology-oncology ward of Dr. Sheikh children's hospital. Iran J Pediatr Hematol Oncol 2015; 5: 179-185.
2. Rutledge-Taylor K, Matlow A, Gravel D. A point prevalence survey of health care-associated infections in Canadian pediatric inpatients. Am J Infect Control 2012; 40: 491-496.
3. Dresbach T, Prusseit J, Breuer J. Incidence of nosocomial infections in children undergoing cardiac surgery. Rev Med Microbiol 2009; 20: 74-83.
4. Fesih A, Recep T, Ali G. Determining the independent risk factors and mortality rate of nosocomial infections in pediatric patients. Biomed Res Int 2016; 2016: 7240864.
5. Macartney KK, Gorelick MH, Manning ML. Nosocomial respiratory syncytial virus infections: the cost-effectiveness and cost-benefit of infection control. Pediatrics 2000; 106: 520-526.
6. Bhattacharyya N, Kosloske AM, Macarthur C. Nosocomial infection in pediatric surgical patients: A study of 608 infants and children. J Pediatr Surg 1993; 28: 343-344.
7. Wiuff C, Murdoch H, Coia JE. Control of Clostridium difficile infection in the hospital setting. Exp Rev Anti-Infect Ther 2014; 12: 457-469.
8. Roy C, Gray C, Ruda L. High-dose, extended-interval gentamicin and tobramycin for pediatric inpatients: a survey of Canadian hospital pharmacists. Canadian J Hosp Pharm 2016; 69: 367-375.
9. Russell GH, Kaplan JL, Youngster I. Fecal transplant for recurrent Clostridium difficile infection in children with and without inflammatory bowel disease. J Pediatr Gastroenterol Nutr 2014; 58: 588-592.
10. Youngster I, Sauk J, Pindar C. Fecal microbiota transplant for relapsing Clostridium difficile infection using a frozen inoculum from unrelated donors: a randomized, open-label, controlled pilot study. Clin Infect Dis Off Publ Infect Dis Soc Am 2014; 58: 1515-1522.
11. Youngster I, Mahabamunuge J, Systrom HK. Oral, frozen fecal microbiota transplant (FMT) capsules for recurrent Clostridium difficile infection. BMC Med 2016; 14: 134.
12. Bakken JS. Feces transplantation for recurrent Clostridium difficile infection: US experience and recommendations. Microb Ecol Health Dis 2015; 26: 27657.
13. Chin SM, Sauk J, Mahabamunuge J. Fecal microbiota transplantation for recurrent Clostridium difficile infection in patients with inflammatory bowel disease: a single-

center experience. Clin Gastroenterol Hepatol 2017; 15: 597-599.

14. Russell G, Kaplan J, Ferraro M. Fecal bacteriotherapy for relapsing Clostridium difficile infection in a child: a proposed treatment protocol. Pediatrics 2010; 126: 239.
15. Kelly CR, Ihunnah C, Fischer M. Fecal microbiota transplant for treatment of Clostridium difficile infection in immunocompromised patients. Am J Gastroenterol 2014; 109: 1065-1071.

***Correspondence to**

Xiuzhen Zhao

Department of Pediatrics

Zhangqiu People's Hospital

PR China