

## Original Article

# Clinical observation of antibiotics in preventing nosocomial infection in premature infants

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**Abstract:** Objective: To study the possibility of lower the nosocomial infection rate among the premature infants by prophylactic use of antibiotics. Methods: Retrospectively collect 409 premature infants admitted to the neonatal intensive care unit (NICU) of First Hospital of Jilin University between 1st January in 2009 and 31st December in 2011, who meet inclusion criteria. There were prophylactic group and nonprophylactic group randomly divided and compared the nosocomial infection rates of two groups. Results: The hospital infection rate of the prophylactic group was 62.9%, and the rate of the non-prophylactic group was 47.3%. There was a significant difference between the two groups ( $P < 0.05$ ). On the contrary, the prophylactic use of antibiotics could increase the incidence of the nosocomial infection. Conclusion: It does more harm than good that prophylactic use of antibiotics to prevent premature nosocomial infection.

**Keywords:** Antibiotics, nosocomial infection, premature, prophylactic

## Introduction

In recent years, the survival rate of premature infants has increased significantly with the neonatal diagnosis and treatment level gradually improved. However, the incidence of premature infants hospital infection has been on the rise, which is the main reason of premature death [1, 2]. Under this condition, people pay more attention to the application of antibiotics. It has become one of researches hot that whether prophylactic use of antibiotics for premature infants could reduce the incidence of hospital infection in recent years [3]. This is especially pertinent for premature infants because they present other risk factors for renal dysfunction (growth retardation, immature renal function, patent ductus arteriosus, hemodynamic failure, and other toxic drug treatments). When renal impairment occurs, vancomycin treatment is discontinued, and the next administration depends on vancomycin plasma concentration which is measured daily, after collection of blood from an invasive blood puncture. In present study, a retrospective statistics of the hospital infection occurrences of premature

infants from First Hospital of Jilin University between 1st January in 2009 and 31st December in 2011 was analyzed to determine the relationship between the prophylactic use of antibiotics and premature hospital infections, which aims to guide the clinical reasonable application of antibiotics in preterm neonates.

## Materials and methods

### Materials

Retrospectively collect premature infants admitted to the neonatal intensive care unit (NICU) of First Hospital of Jilin University between 1st January in 2009 and 31st December in 2011. Inclusion criteria: (1) admission to hospital within 24 h after birth; (2) the time of admission  $\geq 48$  h; (3) case data completion; (4) except a clear prenatal history of bacterial infection; (5) total 409 cases of no infectious diseases on admission, no intracranial hemorrhage which randomly divided prophylactic group and nonprophylactic group. The gestational age and birth weight compare  $p$  values were  $> 0.05$ , which have no significant difference in the two groups.

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**Table 1.** The assignment of factors associated with premature hospital infection

Associating factors	Assignment	
PROM	>12 h = 1	No or ≤12 h = 0
Meconium-staining amniotic fluid	Yes = 1	No = 0
Asphyxia after birth	Yes = 0	No = 0
GA	≤32 w = 1	>32 w = 0
BW	≤1500 g = 1	>1500 g = 0
The onset time of feeding	>5 d after birth = 1	≤5 d after birth = 0
MV	Yes = 1	No = 0
PICC	Yes = 1	No = 0
Arterial intubation	Yes = 1	No = 0
Prophylactic antibiotics	Yes = 1	No = 0
Hospital infection	Yes = 1	No = 0

**Table 2.** The hospital infection of two groups (%)

	Infections (%)	No infections (%)
Prohylactic group (221 cases)	139 (62.9)	82 (37.1)
Nonprohylactic group (188 cases)	89 (47.3)	99(52.7)
$\chi^2$	9.96	
<i>P</i>	0.001	

**Table 3.** The results of many factors uncondition stepwise Logistic analysis for hospital infection of preterm neonates

Dangerous factors	B	S.E.	Wald	Sig.	Exp (B)	Exp (B) 95% CI
GA	0.553	0.257	4.636	0.031	1.738	1.051~2.874
BW	0.615	0.287	4.582	0.032	1.849	1.053~3.284
MV	0.727	0.386	3.551	0.060	2.068	0.971~4.403
PICC	-0.234	0.348	0.452	0.501	0.791	0.400~1.565
Arterial intubation	0.377	0.479	0.621	0.431	1.458	0.571~3.727
The onset time of feeding	0.215	0.357	0.362	0.547	1.240	0.616~2.497
Prophylactic antibiotics	0.028	0.255	0.012	0.911	1.029	0.625~1.694

### Method

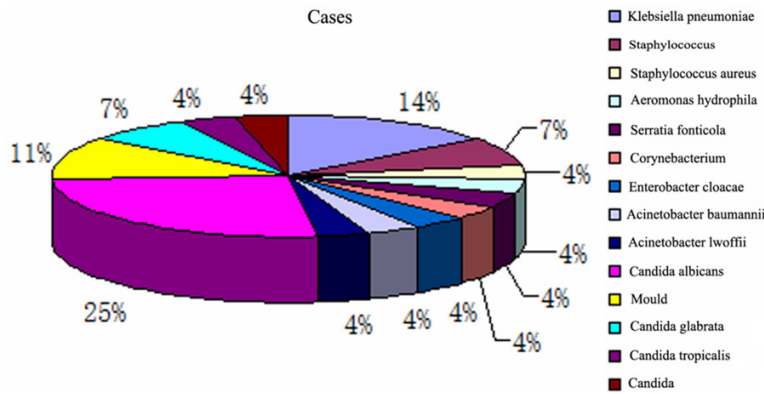
The homemade form was filled in item by item through the detailed referring to medical records. The diagnostic criteria for hospital infection was referred to hospital infection diagnostic criteria which promulgated in 2001 by the ministry of health of the People's Republic of China (Trial). Firstly, the chi-square test was used to determine the relationship between the prophylactic use of antibiotics with the premature hospital infection. Then, suspicious risk factors of premature hospital infection and the prophylactic use of antibiotics were evaluated, respectively (total 10 classes) (**Table 1**). And

chi-square test was carried following, which makes to preliminary screen of variables. The significant variables were selected as the independent variables to substitute the Logistic regression equation to further determine whether the relationship between the prophylactic use of antibiotics and premature infants in hospital infection under the action of multiple factors was changed than previous. This is to further determine the relationship between the two and calculate the contact strength of each factor and the onset, which was the OR value and its 95% confidence interval. SPSS 17.0 software was used to complete data analysis in this study.

### Results

Among the 409 cases, there were 139 cases happened hospital infection (62.9%) of the prevention use of antibiotics group with 221 cases and 89 cases happened hospital infection (47.3%) of the non-prevention use of antibiotics group with 188 cases. **Table 2** showed the statistical differences of chi-square test. Then, the significance of variables after chi-square test analysis and the prophylactic use of antibiotics in many factors were substituted the uncondition stepwise Logistic regression equation. The results showed that the prophylactic use of antibiotics and hospital infection were no significant correlation in preterm neonates. However, the  $GA \leq 32$  w and  $BW \leq 1500$  g were independent risk factors for nosocomial infection in preterm neonates, which were statistically significant ( $P < 0.05$ , 95% CI, **Table 3**). This suggested that

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**Figure 1.** The distribution of hospital infection pathogenic bacteria.

the occurrence of premature hospital infection was determined together by many factors and influenced together. The prophylactic use of antibiotics was the risk factor for premature infant of hospital infection, but was not the independent risk factors. In addition, the hospital infection included pneumonia, sepsis, purulent meningitis, urinary tract infection, intestinal infection, and neonatal infection. A total of 26 pathogenic bacteria strains isolated from laboratory examination, which were all conditioned pathogen. There were 12 bacteria strains (45%) of which 4 *Klebsiella pneumoniae*, 3 intestinal tract pathogenic bacteria such as *Enterobacter cloacae*, 2 *Staphylococcus haemolyticus*, 1 *Acinetobacter baumannii*, 1 *Acinetobacter Iwoffii*, and 1 *Staphylococcus aureus*. There were 14 fungus (54%) of which 7 *Candida albicans*, 3 Mould, 2 *Candida glabrata*, 1 *Candida*, and 1 *Candida tropicalis* (**Figure 1**).

### Discussion

As the application of antibiotics in premature infants, many specialists suggested that prophylactic use of antibiotics for premature infants could reduce the incidence of hospital infection [3, 4]. However, others thought that premature infants should not use antibiotics for prophylactic. In present study, it has significant difference in nosocomial infection of the two groups after single factor chi-square test analysis. The incidence rate of prophylactic group was higher than the nonprophylactic group in hospital infection of preterm neonates. However, when the prophylactic use of antibiotics in many factors were substitute the uncodition stepwise Logistic regression analysis, the

prophylactic use of antibiotics and hospital infection were no significant correlation in preterm neonates. So, it further concluded that premature hospital infection was determined by many factors and influenced together. While under the effect of multiple factors, the prophylactic use of antibiotics was not the independent risk factor for nosocomial infection in preterm neonates. But under the effect of single factor, the prophylactic use of antibiotics not only can't pre-

protect the premature hospital infection, but also increased the incidence. Therefore, the prophylactic use of antibiotics for premature infants was not advocated in clinical. As it has not yet been established of normal flora for premature infants after birth, the prophylactic use of antibiotics may affect the normal flora establishment to further lead infection. Particularly broad-spectrum antibiotics for a long time used could cause flora imbalance and conditional pathogenic bacteria infection. In recent studies suggested fungal infection had become the main pathogenic bacteria in nosocomial infection for premature infants, which should draw high attention [5, 6]. Other reported that long-term application of the third generation cephalosporin and the carbon blue enzyme alkenes medicine could increase the production of beta lactamase gram-negative bacillus especially with *Klebsiella pneumoniae* infection [7]. And it also increased the incidence rate of fungal infection [8]. Our study have found 26 pathogenic bacteria strains isolated from the laboratory, which were all conditional pathogenic bacteria. And the 26 cases were all the prophylactic use of 2 and 3 generation cephalosporin history, which 12 cases of bacteria (46%) with *Klebsiella pneumoniae* dominant and 16 cases of fungus (54%) with *Candida albicans* dominant. Those suggested that fungal infection has become the main pathogenic bacteria in nosocomial infection. This result was the same as previous studies. Long-term use of antibiotics can also contribute to the development of antibiotic resistance in bacteria, which seriously affect the anti-infection treatment effect once infection happened. In addition, each organ system is not mature in premature infants. The metab-

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olism and excretion of antibiotics happened mainly in the liver and kidney. Because of liver, kidney undevelopment and liver enzyme secretion insufficient or lack and low kidney removal function, a lot of antibiotics can cause premature damage of liver and kidney function, which should avoid as far as possible. So, for premature infants, it is significant important for reasonable use of antibiotics. The prophylactic use of antibiotics not only can not reduce the incidence of hospital infection, but also it may increase the occurrence of hospital infection, particularly multi-resistant bacteria of hospital infection. Therefore, prophylactic use of antibiotics is not recommended for premature infants with no signs of infection. It must be strictly grasp the indications for the use of antibiotics and minimize the use of broad-spectrum antibiotics and decrease the application time. At the same time, it should be paid attention to the use dosage of antibiotics in the process of application antibiotics for infection. Use short course antibiotics as far as possible, avoid to cause liver and kidney function damage, and reduce the conditional pathogenic bacteria infection and incidence of bacterial drug resistance, and avoid the double infection happened. Reasonable use of antibiotics is the key to the prevention and control of hospital infection in premature infants.

### Disclosure of conflict of interest

None.

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