NEONATAL INFECTION AND RISK FACTORS IN PREGNANCIES WITH PREMATURE RUPTURE OF MEMBRANES IN TU DU HOSPITAL

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ABSTRACT

Background: *Neonatal infection is a common disease in neonates and which is one of the four leading causes of infant mortality.* ***Objective:*** *To investigate the rate of neonatal infection and risk factors for infections of live infants born in mothers with premature rupture of membranes at Tu Du Hospital.* ***Patients and Method:*** *Review of medical records of live infants born in mothers with premature rupture of membranes diagnosed as neonatal infections and other non-infectious diseases at Tu Du Hospital from January 1, 2020 to June 30, 2020.*

Results: *Among 255 live babies born from mothers with premature rupture of membranes, 24 babies had neonatal infection, accounting for 9.41%. In which, there were mainly pneumonia with 21 children (8.2%) followed by necrotizing enterocolitis with 2 children (0.9%), one child with skin infection (0.4%) and 1 child with umbilical cord infection (0.4%). The most common clinical manifestations in neonatal infection were tachypnea (91.7%) and chest indrawing (79.2%) followed by asphyxia and vomiting (20.8%). The least common is fever, cyanosis, skin pustules, each sign accounted for only 4.2%. In terms of subclinical examination, leukocytosis was most common with 17(70.8%) infants, then increased CRP, only 4(18.2%) infants and decreased platelets with 3(12.5%) infants and at least 1 (4.2%) infant with positive blood culture. Meanwhile, chest Radiography has lesions up to 21(87.5%) cases and abdominal Radiography with lesions is 2 (8.3%) cases. Risk factors associated with neonatal infection are time to premature rupture of membranes greater than 18 hours, low apgar score of 0-7 points, tachypnea, chest indrawing, vomiting, chest radiography and abdominal radiographs with lesions (p=000 and 0.009).*

Conclusion: *Neonatal infection is common in neonates whose mothers' membranes have broken prematurely. It is necessary to monitor and detect early clinical and subclinical signs at risk of infection in neonates.*

Keywords: *Neonatal infection, Premature rupture of membrane.*

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1. INTRODUCTION

Neonatal infection is a common disease in neonates, and it is one of the four leading causes of neonatal death. According to the World Health Organization (WHO), neonatal infection-caused mortality is the highest, accounting for 42%, followed by postpartum asphyxia (31.7%), congenital disorder (16%) and premature birth (10.3%). Recently, the frequency of infections has been increasing, with a rate of 0.5/1000 live infants [5]. If diagnosed early and treated as soon as neonatal infection is suspected, it will contribute to reducing the neonatal mortality, reducing the burden on the family and society. There are many causes and risk factors for early neonatal infection, including prolonged rupture of membranes and dirty amniotic fluid. Premature rupture of membranes occurs in 5 to 10% of full-term pregnancies [12]. Clinical and subclinical follow-up combined with risk factors is one of the measures to detect neonatal infection early. At Tu Du Hospital, every year, about 10,000 children are admitted to the neonatal department, in which the neonatal infection rate is nearly 4% and the overall annual mortality is up to 4.6%, of which the majority is due to neonatal infection. Therefore, we conducted this study with the aim of determining the neonatal infection rate, clinical and subclinical signs and factors related to neonatal infection in mothers with premature rupture of membranes at Tu Du hospital.

2. SUBJECTS AND METHODS

2.1. Research design: Descriptive, Retrospective study.

2.2. Research subjects

All live infants born from mothers with premature rupture of membranes during the period of 6 months from January 2020 to June 2020. Neonates are clinically followed up and subject to subclinical test.

2.3. Research methods

Review medical records of live infants born from mothers with premature rupture of membranes diagnosed with neonatal infection and other diagnoses without neonatal infection. Clinical and subclinical data are collected from hospital's medical records.

Inclusion criteria in the study are well-informed medical records related to neonatal infection or non-infection.

Exclude medical records with insufficient data or missing information of the infants and other information or infant death or hospitalization.

2.4. Data processing

Data are processed by medical statistical method, using statistical software SPSS 20.0.

3. RESULTS

Among 255 live infants born from mothers with premature rupture of membranes, there are 24 ones with neonatal infection, accounting for 9.41%, mainly pneumonia with 21 ones (8.2%) followed by 2 ones with necrotizing enterocolitis with (0.9%), one with skin infection (0.4%) and one with umbilical cord infection (0.4%).

Table 1. General characteristics of neonates with infection

Neonatal features of infection		Number of patients (n= 24)	Ratio (%)
Gender	Male	14	58.3
	Female	10	41.7
Weight	Low birth weight (<2500g)	16	66.7
	Standard weight (≥2500g)	8	33.3
Gestational age	Premature birth (<37 weeks)	17	70.8
	Full term (≥37 weeks)	7	29.2
Rupture of membrane duration	Premature rupture of membranes > 18 hours	14	58.3
	Premature rupture of membranes ≤ 18 hours	10	41.7

Table 1 showed that neonatal infection characteristics of infants born from mothers with premature rupture of membranes are common in male infants (58.3%), low birth weight (66.7%), premature birth (70.8%). The most common duration of premature rupture of membranes is over 18 hours (58.3%).

Table 2. Clinical manifestations of neonatal infection

Clinical manifestations	Number of patients (n= 24)	Ratio (%)
Tachypnea	22	91.7
Chest indrawing	19	79.2
Asphyxiation	5	20.8
Vomiting	5	20.8
Fever	1	4.2
Cyanosis	1	4.2
Skin pustule	1	4.2
Shock	1	4.2

The result in Table 2 showed that the most common clinical manifestations in neonatal infection are tachypnea (91.7%) and chest indrawing (79.2%) followed by asphyxia and vomiting (20.8%), the least common was fever, cyanosis, skin pustule, each manifestation accounted for only 4.2%

Table 3. Subclinical characteristics of neonates with infection

Subclinical	Number of patients (n= 24)	Ratio (%)
Leukocytosis	17	70.8
Leukopenia	1	4.2
Plastocytopenia	3	12.5
Increased CRP	4	18.2
Blood culture (+)	1	4.2
Chest radiography showing pneumonia with lesion	21	87.5
Abdominal Radiography with lesion	2	8.3

Table 3 showed that in blood tests, leukocytosis was most common with 17 (70.8%) neonates, then only 4 (18.2%) ones with increased CRP and 3 (12.5%) ones with plastocytopenia and at least 1 (4.2%) positive blood culture. Meanwhile, chest radiography showing pneumonia with lesion was up to 21 (87.5%) cases and 2 (8.3%) cases with abdominal Radiography.

Table 4. Relationship between clinical characteristics and neonatal infection

Characteristics		Infection (n=24)	Non-infection (n=231)	OR (95%CI); P
Premature rupture of membranes	>18 hours	13	21	OR =11.8(4.71-29.64) P=0.0000
	18 hours	11	210	
Amniotic fluid color	Dirty	0	2	P=1
	Normal/unknown	24	229	
Maternal fever before giving birth	Yes	0	1	P=1
	No	24	230	
Apgar after birth	0-7 points	5	2	OR=30.1(5.47-165.8) P=0.0000
	8-10 points	19	229	
Fever	Yes	1	0	P=0.094
	No	23	231	
Tachypnea	Yes	22	2	OR=1259.5(169-9383) P=0.0000
	No	2	229	
Cyanosis	Yes	1	0	P=0.094
	No	23	231	
Chest indrawing	Yes	19	2	OR=435.1(79.0-2394) P=0.0000
	No	5	229	
Skin pustule	Yes	1	0	P=0.094
	No	23	231	
Shock	Yes	1	0	P=0.094
	No	23	231	
Vomiting	Yes	5	0	P=0.0000
	No	19	231	

The result in Table 4 showed that premature rupture of membranes over 18 hours, low apgar point after birth at 0-7 points, tachypnea, chest indrawing and vomiting are signs associated with neonatal infection with p = 0.000. The relationship between the color of dirty amniotic fluid, maternal fever before giving birth, neonatal fever, cyanosis, skin pustules, shock and neonatal infection has not been found because these signs were rare.

Table 5. Relationship between subclinical and neonatal infections

Characteristics		Infection (n=24)	Non-infection (n=231)	OR(95%CI); P
Leucocyte	Increase	17	28	OR=0.20(0.036-1.119) P=0.065
	Normal	6	2	
Platelet	Decrease	3	1	OR=4.14(0.40-42.6) P=0, 312
	Normal	21	29	
CRP	Increase	4	7	OR=0.73(0.184-2.88) P=0.741
	Normal	18	23	
Chest radiography showing pneumonia with lesion	Yes	17	0	P=0.0000
	No	7	231	
Abdominal radiography with lesion	Yes	2	0	P=0.009
	No	22	231	
Blood culture	Positive	1	1	OR=10.0(0.60-165.9) P=0.179
	Negative	23	231	

The result in Table 5 showed that, chest radiography showing pneumonia and abdominal Radiography with lesions were the most significantly related subclinical factors (p = 0.000 and 0.009). Blood tests such as leukocytosis, peripheral thrombocytopenia, CRP and blood culture were not significantly associated, possibly due to limited research data.

4. DISCUSSION

The rate of neonatal infection in our study was 9.41%, 25% lower than that of Wu J et al., of which more than half was pneumonia (12.9%) [11]. Ibishi VA et al. showed that the rate of early neonatal infection in mothers with premature rupture of membranes was 13%, of which 5% were neonatal infection [8]. However, that of our study was much higher than that in Tran Dieu Linh's study at the National Hospital of Obstetrics and Gynecology, showing that early neonatal infection was 1.7% [3]. Pneumonia was the most common neonatal infectious disease, accounting for 87.5%, consistent with other studies. The study of Ta Van Tram et al. at Tien Giang Central General Hospital showed that neonatal pneumonia was also higher than other neonatal infections, accounting for 8.2%, umbilical cord inflammation 1.7%, sepsis 0.5% [4]. Regarding gender, our study showed that male neonates accounted for 58.3%, higher than female neonates (41.7%). This rate was similar to the study of Tran Thu Ha at Bac Ninh Obstetrics and Pediatric Hospital, 55.2% in men and 44.8% in women [2]. The rate of low birth weight according to our study was 66.7% and the rate of premature birth was 70.8% similar to the study of Wu J et al., the rate of premature birth in mothers with premature rupture of membranes was 72.43% [11].

Among 24 neonatal infection cases, 91% had tachypnea, one of the common signs of pneumonia, and 20.8% had postpartum asphyxia with an apgar point of 0-7, 4.16% of cases had fever and vomiting. This result was similar to other studies with the rate of

tachypnea also accounted for the majority [1]. There was only 1 case of positive blood culture, accounting for 8.3% and the found bacteria was Cupria vidus pauculus. This was an uncommon Gram-negative bacterium in neonatal infection, reported in a case in India by Duggal S et al., in which sepsis went with meningitis [7]. However, Wu J et al. showed a high rate of positive blood culture at 38.7% (63/163). The main pathogenic bacteria detected in blood culture were Gram-positive (45.9%) and Gram-negative (54.1%). The predominant Gram - positive bacteria were S. haemolyticus and S. epidermidis (16/63) and the predominant Gram - negative bacteria were K. pneumoniae (19/63) and E. coli (9/63). Only 2 premature neonates had the fungus detected (3.2%) [11].

Our study has not recorded the association between dirty amniotic fluid and neonatal infection, possibly because the sample size is small and the deaths or hospitalizations do not have data to study, so the results were different from those of other authors. Our study showed that the risk of neonatal infection was high when the time of premature rupture of membranes was more than 18 hours (OR=11.8(4.71-29.64); P=0,000). Yasmina A et al. studied on 144 cases of premature rupture of membranes, showing that: 6 (4%) cases of rupture of membranes from 6 to 12 hours, 14 (9.7%) from 12 to 18 hours, 28 (19.4%) from 18-24 hours and 96 (66.6%) over 24 hours [12]. Ocviyanti D et al. found a higher risk of neonatal infection in mothers with premature rupture of membranes of 18 hours or more with OR=3.08, 15 hours or more with OR=7.32 and ≥48 hours with OR=5.77. The risk of neonatal infection was higher in premature fetuses with a gestational age of <37 weeks with an OR=18.59 [9].

Next was other risks such as low apgar point after birth from 0-7 points (OR=30.1(5.47-165.8); P=0,000), tachypnea (OR=1259.5(169-9383); P=0,000) and chest indrawing (OR=435.1(79.0-2394); P=0,000) were both associated with neonatal infection. Similarly, chest radiography showing pneumonia and abdominal radiography with lesions were significantly associated with neonatal infections of the lungs and abdomen, such as pneumonia and necrotizing enterocolitis (p=0.000 and 0.009). However, our study has not found an association of leukocytosis, plastocytopenia, increased CRP, blood culture related to neonatal infection.

Qiu X et al. [10] studied the association between sepsis in neonates from mothers with premature rupture of membranes, showing sensitivity, specificity, positive and negative predictive value, odds ratio (OR) and the area under the curve (AUC) were: 0.85 (95% CI: 0.81-0.91); 0.88 (95% CI: 0.86-0.91); 9.94 (95% CI: 4.27-23.15); 0.14 (95% CI: 0.06-0.32); 79.26 (95% CI: 23.42-268.26), and 0.9473, showing a strong association and high accuracy in the diagnosis of neonatal infection with mothers suffering premature rupture of membranes (P=0.0351).

Upon multivariate logistic regression analysis, Baizat M et al. found that there was a correlation between clinical factors and neonatal infection: maternal urinary tract infection (OR = 3.05), heart failure (OR). = 5.28), number of hospitalized days (OR = 1.09) and CRP (OR = 3.26) were independent risk factors significantly associated with early neonatal infection. Univariate analysis showed that the predictors of early neonatal infection were gestational age (p=0.002), birth weight (p=0.014), Apgar point at 1 minute (p=0.012), maternal urinary tract infection (p=0.008), surfactant use (p < 0.001), heart failure (p<0.001)

and CRP (p<0.001). Meanwhile, multivariate regression analysis showed that the remaining risk factors for neonatal infection were: surfactant use (OR = 6.73) and CRP (OR = 3.51). Univariate analysis showed that the predictors of late neonatal infection were gestational age (p = 0.001), birth weight (p = 0.048), first minute Apgar point (p = 0.001), surfactant use (P = 0.001). p < 0.001), hypocalcaemia (p = 0.03), heart failure (p=0.003), CRP (p<0.001), mechanical ventilation (p<0.001), and number of hospitalized days (p<0.001). In the multivariable model, the remaining risk factors for late neonatal infection were: number of hospitalized days (OR=1.11) and heart failure (OR = 5.98) [6].

The reason for having some data differences between our study and other authors may be from our small sample size and low number of neonatal infections, affecting the study result. Furthermore, our study did not collect death cases or hospitalization case because there were no data to study.

5. CONCLUSION

The overall rate of neonatal infection in mothers with premature rupture of membranes is 9.16%, of which pneumonia was the most common. The clinical and subclinical signs encountered in neonatal infection were diverse: tachypnea, chest indrawing, asphyxia, vomiting, fever, cyanosis, skin pustules, shock, leukopenia and plastocytopenia, increased CRP, blood culture (+) and chest radiography showing pneumonia or abdominal radiography with lesions. Risk factors associated with neonatal infection were duration of premature rupture of membranes lasting more than 18 hours, low postpartum apgar point, tachypnea, chest indrawing, vomiting and chest radiography showing pneumonia or abdominal radiography with lesions.

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