

Does E-Coli play an important role in neonatal sepsis in preterm prelabour rupture of membrane?

Original
Article

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ABSTRACT

Aim: The aim of this study was to detect the most common causative organism causing neonatal sepsis in women suffered preterm prelabour rupture of membranes and if it is different from that of the maternal genital swab.

Materials and Methods: This study was carried out on 200 pregnant women with PPRM at gestational age between 23 weeks plus 6 days to 28 weeks. Genital swabs were taken for microbiological study and all women were managed conservatively. After delivery, buccal and nasal swab were taken from the neonates and the detected organism(s) were correlated with those detected from the mothers' swabs. Also, neonatal outcome was studied regarding incidence of neonatal sepsis, Neonatal Intensive Care Unit) admission and neonatal mortality.

Results: From the 200 enrolled cases and their neonates, there were thirty-three neonates (16.5%) that were admitted to the NICU with twenty-one neonates (67.8%) of them suffering neonatal sepsis. Only thirteen neonates (61.9%) of those who had suffered sepsis shared the same organisms with their mothers. The other eight cases (38.1%) had different organisms. The most frequent organism regarding maternal vaginal swabs was Escherichia coli followed by Group B Streptococci sharing the same frequency with non-hemolytic Streptococci, Staphylococcus aureus and Group A streptococci sharing the same frequency with Klebsiella species.

Conclusion: E-coli is the most common causative organism for neonatal sepsis in PPRM before 28 weeks of gestation.

Key Words: Chorioamnionitis, neonatal sepsis, PPRM

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INTRODUCTION

Preterm prelabour rupture of fetal membranes (PPROM) occurs in 8% of pregnancies (3% before and 5% after 37 weeks of gestation). Accurate prediction of infection, including maternal chorioamnionitis and early onset neonatal infection remains a critical challenge in these cases. Despite recent advances in prenatal care, preterm PROM (PPROM) continues to lead to important obstetric complications. The frequency and severity of neonatal complications after PPRM vary with the gestational age at which rupture and delivery occur. In particular, the risk of complications increases with decreasing gestational age at membrane rupture and delivery^[14].

PPROM is significant not only in perinatal morbidity and mortality, but also in the long term neonatal complications and sequelae in survived neonates^[18]. Although mortality from acute amnionitis is rare, significant maternal morbidity may still occur when caesarean section (CS) is required. About 11% of patients with amnionitis delivered by CS may require additional

antimicrobial therapy for persistent serious pelvic infection. Of those, about 4.5% may require debridement and drainage of subcutaneous wound infections. In patients with amnionitis delivered vaginally, about 1.5% requires additional therapy^[12]. Early onset neonatal sepsis which is generally acquired prenatally in pregnancies with PPRM is the most serious consequence of maternal infection and is associated with increased neonatal morbidity and mortality^[11].

Mortality from neonatal sepsis may be as high as 50% for infants who are not treated. Infection is a major cause of fatality during the first month of life, contributing to 13-15% of all neonatal deaths. Low birth weight and gram-negative infection are associated with adverse outcomes^[7].

The use of maternal laboratory markers at or after 24 weeks of gestation would help to distinguish women at risk from those who don't require active management, for whom pregnancy can be safely prolonged (Shin Park, 2007). Prenatal maternal markers of infection

at or after 24 weeks have, however, been insufficiently studied. Those that might be easily used in routine care are serum C-reactive protein (CRP) levels, white blood cell counts (WBC count), and bacterial analysis of vaginal samples. No study has included enough women at or after 24 weeks of gestation to allow the predictive values of these markers to be estimated^[11].

AIM OF THE WORK

The aim of this study was to correlate between maternal organisms collected from the genital tract after PPRM and those obtained from the neonates who suffered from neonatal sepsis and detect if it was the same organism or different.

PATIENTS AND METHODS

This study was carried out on 200 pregnant women with PROM at Minia University Hospital for Obstetrics and Gynecology and Minia General Hospital during the period between March 2015 and November 2016 after being approved by the ethical committee of the department. The inclusion criteria were ; all women with definite history of PPRM between 23 weeks plus 6 days and 28 weeks gestational age and candidate for active conservative management which include maternal monitoring to diagnose chorioamnionitis both clinically and laboratory including complete blood count, CRP and blood culture done in case of presence of infection. All women were given 250 mg erythromycin twice daily till delivery.

Also, betamethasone was given for all women as 12 mg daily for two consecutive days only once.

Exclusion criteria were ; gestational age less than 23 weeks plus 6 days or after 28 weeks. Any signs of maternal sepsis, women with intrauterine fetal death, fetus with congenital anomalies, immunocompromised women.

For all women, proper history was taken, vital signs recorded, general and abdominal examination excluding chorioamnionitis. Then cusco-speculum examination to show amniotic fluid collected on the posterior fornix of the vagina, and at the same time genital swab taken for microbiological study. Then, another swab was taken immediately at delivery time, at least one genital swab taken

from all included women especially immediately before delivery. Then, after delivery; whether vaginal delivery or by CS ; all neonates were assessed by a pediatrician to assess APGAR scoring at one and five minutes.

After that, a buccal or a nasal swab was taken from the septic newborn or those indicated for incubation. The samples were sent to the laboratory. After reaching the laboratory and under supervision of a microbiologist, the swabs were incubated at 37°C for 24 hours and observed for growth and multiplication of the organisms and were then cultured on plates that were previously prepared and sterilized with the suitable media.

These media included ready-made media e.g. MacConkey's agar, nutrient agar, nutrient broth, bacto-peptone, potassium dihydrogen orthophosphate, methyl red HCl and ethanol. Prepared media included blood agar, sugar fermentation test media and semi-solid nutrient agar. The correlations between maternal and neonatal swabs culture results was performed to determine if the causative organism in neonatal sepsis is the same as those obtained by maternal samples.

RESULTS

This study showed the sociodemographic data of the included women in Table 1.

There were 35 delivered cases incubated for different causes including prematurity and low birth weight in 8 cases, infant of diabetic mothers in 2 cases, 4 with RDS and 21 cases due to neonatal sepsis (Table 2).

The isolated organisms from genital swab at admission and at time of delivery and those of neonatal septic swabs were shown in table 3.

Moreover, table 3 showed that there are 21 neonates who were incubated because of neonatal sepsis. 13 neonates shared the same maternal organism(s) while the other eight cases developed another infection other than that of their mothers. Also, from this study, the commonest genital organism seen were *E. coli*, followed by group B Streptococci (GBS), *Klebsiella* and *Staphylococcus aureus* (*S. aureus*). In septic neonates, the highest prevalence was for *E. coli*, followed by GBS, then *S. aureus*.

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Table 1: Socio-demographic criteria of the study population

Parameters	Percentage
Gestational age at PPRM	
< 24 weeks	25 (12.5%)
> 24 weeks	125 (87.5%)
Gestational age at delivery	
Before 28 weeks	170 (85%)
After 28 weeks	30 (15%)
Mode of delivery	
CS	123 (61.5%)
NVD	77 (38.5%)

Table 2: Indications for incubation

Indication for incubation	N= 35 (%)
Neonatal sepsis	21 (%)
Prematurity and low birth weight	8
RDS	4
Infant of diabetic mother	2

Table 3: Types of isolated organisms from maternal and neonatal swabs

Organism	Mother		NEONATAL SEPTIC SWAB
	Admission	Delivery	
Klebsiella	20	12	0
Escherichia coli (E. coli)	112	104	14
Non-hemolytic Streptococci	7	3	0
Group A hemolytic Sterptococci	2	0	0
Group B hemolytic Streptococci	75	60	4
Staph. aureus	15	7	2
Mixed	52	49	1

DISCUSSION

This study was performed at Minia University Hospital for Obstetrics and Gynecology and Minia General Hospital with about 10.5% of the neonates of mothers with PPRM who suffered neonatal sepsis due to chorioamnionitis after PPRM.

PPROM is one of the major risk factors of early onset neonatal sepsis that seems to be greater in hospitals caring for low socioeconomic population (Osmanagaoglu 2004). Maternal age, parity and increased maternal weight do not seem to cause PPRM^[10].

The rates of occurrence of PPRM and early onset neonatal sepsis are increased with low socioeconomic states^[2] and low nutritional states^[17], that was confirmed in this study by including a greater ratio of illiterates (54.4%), nonworking women (92.5%) and those living in rural areas (75%).

In this study, the rate of cesarean deliveries (61.5% of all cases) was high. The cause of increasing rates of CS deliveries in the included cases is the presence of other obstetrical problems and bad obstetric history for many cases included in this study. About forty cases (20.0%) had history of previous abortions and intra uterine fetal death, four cases (2.0%) had previous history of diabetes and abortion or intra uterine growth restriction and two cases (1.0%) had previous history of myomectomy while other cases are due to mal-presentations or repeated caesarean section.

All these complications affected the decision of the obstetricians belonging to the mode of delivery causing increased rates of CS deliveries for the included cases. These findings are similar to that of another study^[12] that recorded higher incidence of CS among populations with PPRM especially if chorioamnionitis developed.

Also, the incidence of neonatal sepsis was noted to be higher among neonates of mothers with longer latency period > 4 weeks. These data are in accordance with that of Mercer who documented that the earlier the occurrence of PPRM and the longer the interval between the rupture of fetal membranes and onset of labor, the more likely is the complications^[8].

RDS is considered one of the most common complications after PPRM at any gestational age^[1]. In this study, RDS was the cause of incubation in twelve cases (36.5%), while both respiratory distress and neonatal infection together were the cause of incubation in four cases (12.1%).

According to the methodology of this study and after isolation and identification of the organisms from the swabs that were taken from the septic foci of the neonates who suffered neonatal sepsis, the results were compared with that of the maternal vaginal swabs in order to correlate between the organisms acquired by the mothers with PPRM and those causing neonatal infection.

In this study, the frequencies of the isolated organisms from the maternal vaginal swabs were *E. coli* that was reported in 104 cases (52%), followed by GBS that was reported in 60 cases (30%), followed by *Klebsiella* infection in 12 cases (6%) then *Staphylococcus aureus* reported in seven cases (3.5%).

On the other hand, in septic neonates, *E. coli* also had the highest prevalence followed by GBS. 13 neonates had the same organisms of that of the mothers ; 8 cases with *E. coli*, 3 cases with GBS and one case with *S. aureus* while the last one had mixed infections.

According to^[6], women with PPRM who suffered chorioamnionitis had higher risk of neonatal infection with GBS and *E. coli* that are the main causative organisms of maternal and accordingly a major part of neonatal infection.

Early onset sepsis usually results from organisms acquired intrapartum^[5]. These findings are in agreement with our neonatal findings which showed that in septic neonates, *E. coli* followed by GBS were the commonest organisms seen with 13 neonates having the same organisms of that of the mothers (8 cases with *E. coli*, 3 cases with GBS and one case with *S. aureus* while the last one mixed infections). In contrast to our results, there was a study performed in the Pediatrics Department at Ain-Shams University in 2012^[4] about the microbiology of neonatal sepsis including 500 neonates. The recorded data regarding the causative organisms of early onset neonatal sepsis were *Klebsiella* species followed by *E. coli*, *S. aureus*, alpha hemolytic *Streptococci* and beta hemolytic *Streptococci*, respectively.

In this regard, the results of Arch Dis Child Fetal Neonatal Ed 2005 (S. vergnano) reported that the pathogens most often implicated in neonatal sepsis in developing countries differ from those seen in developed countries. Overall, gram negative organisms are more common and are mainly represented by *E. coli*, *Klebsiella*, *Pseudomonas* and *Salmonella*^[13]. Of the gram positive organisms, *S. aureus*, coagulase negative *Streptococci*, *Streptococcus pneumoniae*, and *Streptococcus pyogenes* are the most commonly

isolates (Nizet and Klein,2010). On the other hand, beta hemolytic Streptococci are generally rare in most of the African studies. In this regard, the incidence is low with the exception of south Africa^[3].

It is not known whether those differences reflect true differences in pathogens across the world, reflecting an epidemiological transition in some countries or whether it reflects an epidemiological bias linked to the fact that earliest onset sepsis neonates die at home before reaching the health facilities and they do not appear in the statistics (ACOG 2008).

In agreement with this study, neonatal surveillance in developing countries generally identifies GBS and *E. coli* as the dominant early onset neonatal sepsis pathogens and *S. aureus* (Chanet 2009).

CONCLUSION

In conclusion, *E. coli* is the most common causative organism for neonatal sepsis in PPRM. Moreover, neonatal infection is directly related to maternal infections.

In contrast, not all isolated maternal infections were associated with neonatal infections, only those who developed clinical or subclinical chorioamnionitis will develop neonatal sepsis. More studies are needed to evaluate the best antimicrobial for prevention of neonatal sepsis in PPRM according the causative organisms in the Egyptian population.

CONFLICT OF INTEREST

There are no conflicts of interest.

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