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Original Research Article

Study of prevalence of genital tract infection in preterm labour and preterm premature rupture of the membranes following fetomaternal outcomes

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ABSTRACT

Background: Preterm premature rupture of the membranes (PPROM) is a risk factor where loss of amniotic fluid prior to onset of labour in pregnancies <37 weeks of gestation as characterized by a painless flow of fluid from of the vagina, which leads to preterm labour (PTL). The objective was to investigate the prevalence of genital tract infection (GTI) infections in cases with PTL and PPROM, also find the common bacteria isolated in such cases, their sensitivity profile to antibiotics and neonatal outcome in tertiary care hospital located in central India.
Methods: A hospital-based prospective observational study was carried out among 60 pregnant women for the period of 1st July 2020 to 30th June 2021. More than half of the pregnant women were presenting as PPROM (53.3%) while a minimum value (46.7%) was presented PTL in the tertiary care hospital at Bhilai, Chhatisgarh.
Results: Among the various microorganisms isolated in HVS, a higher value was observed on CoNS (13.33%) followed by *Candida sp*. (8.33%) and *Klebsiella sp*. (5.00%) while lower value was observed for *Pseudomonas sp*. and *E. coli* (1.67%) among total studied patients. Maximum sensitivity observed with cefepime (66.7%), cefuroxime (55.6%), cefalexin (50.0%), cotrimoxazole (44.0%), vancomycin (44.0%) followed by ampicillin, lincomycin, penicillin, ceftazidime, clindamycin (38.9%) and minimum sensitivity observed with linezolid and teicoplanin (5.6%). Neonatal death did not show any statistically significant association with genital tract infections (GTI).
Conclusions: GTI is significant causative factors of PTL and PPROM. It is always suggested to screen and monitor the antenatal women for the presence of asymptomatic GTI infections.

Keywords: Antibiotic sensitivity, Genital tract infection, Microorganism infection, Neonatal complications, PPROM, Preterm labour

INTRODUCTION

Preterm labour (PTL) is defined as an onset of labour after the period of viability and <37 weeks.[1] On the other hand, preterm premature rupture of the membranes (PPROM) is defined as loss of amniotic fluid prior to onset of labour in pregnancies <37 weeks of gestation, which is featured by a painless flow of fluid that escapes out of the vagina.[2]

In the USA, the preterm delivery rate is 12-13% while in Europe and other developed countries, reported rates are generally 5-9%.[3] In low-income countries, on average, 12.0% of neonates are born prematurely. It was reported that more than 60.0% of preterm births occurred in Africa and South Asia, but preterm birth is truly a worldwide problem. In the lower-income countries, on average of about 12.0% of neonates were delivered too early compared to higher-income countries of about 9.0%.[4] It

was also reported that poor families were at higher risk within countries.[4] Generally, PPROM occurs in 3% of pregnancies and responsible for one third (30-40%) of preterm births.[5] Preterm birth may follow preterm labour with intact membranes in 40% of cases, or PPROM in 30% and iatrogenic about 30%.[6]

Some earlier studies performed to identify the causative agents of genital tract infection (GTI) and obtained different types of microbes such as group B *Streptococcus*, *Mycoplasma hominis*, *Mycoplasma genitalium*, *Treponema pallidum*, *Ureaplasma ureolyticum*, *Chlamydia trachomatis*, *Trichomonas vaginalis*, *Neisseria gonorrhoeae*, etc. recorded in the vaginal swab of pregnant women, later who had observed PTL.[7,8]

GTI leads to many complications such as foetal distress, deformities like facial and skeletal, pulmonary hypoplasia, prematurity, respiratory distress syndrome (RDS), neonatal sepsis (NNS), meconium aspiration syndrome (MAS), birth asphyxia (BA), etc. Neonatal death was also observed of foetus due to preterm or PPROM of pregnant mothers.[9-12]

Majority of study on role of GTI infections in PTL or PPROM have been carried out outside India and few data are available in Indian context. Moreover, study is lacking in the central part of India. Hence, this study was attempted to investigate the prevalence of GTI infections in cases with PTL and PPROM, also find the common bacteria isolated in such cases, their sensitivity profile to antibiotics and fetomaternal outcome in tertiary care hospital located in central India.

METHODS

The present study was investigated to determine the prevalence of GTI in cases with preterm labour and PPROM, also find the common bacteria isolated in such cases, their sensitivity profile to antibiotics and neonatal outcome. This study recruited 60 pregnant women for the period from 1st July 2020 to 30th June 2021.

Inclusion criteria

In the present study, all the pregnant women were included as per following inclusion criteria: singleton pregnancy in age group of 21-35 years with preterm labour (PTL) and preterm premature rupture of membrane (PPROM).

Exclusion criteria

In the present study, all the pregnant women were excluded as per following exclusion criteria: i) PTL and PPROM in patients with polyhydramnios, multifetal gestation; resulting from invasive techniques like amniocentesis, cordocentesis, cervical encirclage. ii) Any pregnant woman whose pregnancy was terminated preterm for any maternal or foetal causes like preeclampsia, eclampsia, placental abruption, congenital anomalies, IUFD. iii) Uterine anomaly. iv) Uterine fibroids. v) Pregnant women <28 weeks and >37 weeks of gestation.

The data was collected with the help of standard, semi structured, pre-validated case record proforma. The data was incorporated in the Microsoft Excel spreadsheets. The categorical variables with special reference to frequency distributions are categorized among patients as per the number and the percentage of the patients. Furthermore, categorical variables were analysed by using the Chi square test. P value <0.05 was considered statistically significant.

RESULTS

Table 1 describes the distribution of diagnosis at admission among patients. More than half of the pregnant women were presenting as PPROM of about 53.3% while a minimum value was observed for presenting as preterm labour of about 46.7% among total studied patients.

Table 1: Frequency distribution of diagnosis at admission among patients.

Diagnosis at admission	Frequency	Percent
Presenting as PTL	28	46.7
Presenting as PPROM	32	53.3
Total	60	100.0

PTL = preterm labour; PPROM = preterm premature rupture of the membranes

Table 2: Frequency distribution of various microorganisms isolated in HVS among patients.

HVS	Frequency	Percent
CoNS	8	13.33
Yeast (*Candida sp.*)	5	8.33
Klebsiella sp.	3	5.00
E. coli	1	1.67
Pseudomonas sp.	1	1.67
Sterile	42	70.00
Total	60	100.0

HVS = High vaginal swabs; CoNS = Coagulase-negative *staphylococci*; *E. coli* = *Escherichia coli*

Table 2 describes the distribution of various microorganisms isolated in high vaginal swabs (HVS) among patients. Among the various microorganisms isolated in HVS of participants, a higher value was observed on CoNS (8, 13.33%) followed by *Candida sp*. (5, 8.33%) and *Klebsiella sp*. (3, 5.00%) while lower value was observed for *Pseudomonas sp*. and *E. coli* (1, 1.67%) among total studied patients.

Table 3: Frequency distribution of antibiotics according to sensitivity pattern for organism (all taken together), isolated in high vaginal swab culture.

Antibiotics	Sensitive n=18 (%)	Resistant n=18 (%)	Antibiotics	Sensitive n=18 (%)	Resistant n=18 (%)
Amikacin	5 (27.8)	0 (0.0)	Cloxacillin	6 (33.3)	2 (11.1)
Ceftazidime	7 (38.9)	5 (27.8)	Roxithromycin	3 (16.7)	5 (27.8)
Cefuroxime	10 (55.6)	2 (11.1)	Linezolid	1 (5.6)	2 (11.1)
Cefepime	12 (66.7)	1 (5.6)	Vancomycin	8 (44.4)	0 (0.0)
Cefalexin	9 (50.0)	2 (11.1)	Clindamycin	7 (38.9)	1 (5.6)
Amoxiclav	3, (16.7)	6 (33.3)	Lincomycin	7 (38.9)	1 (5.6)
Gentamycin	2 (11.1)	2 (11.1)	Penicillin	7 (38.9)	0 (0.0)
Nitrofurantoin	0 (0.0)	0 (0.0)	Teicoplanin	1 (5.6)	0 (0.0)
Ciprofloxacin	3, (16.7)	5 (27.8)	Clotrimazole	5 (27.8)	0 (0.0)
Ampicillin	7 (38.9)	3 (16.7)	Doxycycline	4 (22.2)	0 (0.0)
Cotrimoxazole	8 (44.4)	6 (33.3)	Fluconazole	5 (27.8)	0 (0.0
Azithromycin	6 (33.3)	1 (5.6)			

Amoxiclav = amoxicillin + clavulanic acid

Table 4: Association between HVS and maternal complications and type of delivery.

Maternal complications IP	High vaginal swab		Total	P value
	Sterile n (%)	Positive (%)		
None	23 (54.8)	12 (66.7)	35 (58.3)	0.57
Yes	19 (45.2)	6 (33.3)	25 (41.7)	
Total	42 (100.0)	18 (100.0)	60 (100.0)	
Maternal complications PP				
None	32 (76.2)	15 (83.3)	47 (78.3)	0.73
Yes	10 (23.8)	3 (16.7)	13 (21.7)	
Total	42 (100.0)	18 (100.0)	60 (100.0)	
Mode of delivery				
Vaginal	18 (42.9)	7 (38.9)	25 (41.7)	0.75
Instrumental	1 (2.4)	0 (0.0)	1 (1.7)	
LSCS	23 (54.8)	11 (61.1)	34 (56.7)	
Total	42 (100.0)	18 (100.0)	60 (100.0)	

IP = Intrapartum; PP = Postpartum; LSCS = Lower section caesarean section

Table 5: Association between HVS and neonatal complications.

Neonatal complications	HVS		Total (%)	p value
	Sterile (%)	Positive (%)		
NNJ	10 (23.8)	7 (38.9)	17 (28.3)	0.38
NNS	7 (16.7)	4 (22.2)	11 (18.3)	0.86
RDS	9 (21.4)	7 (38.9)	16 (26.7)	0.16
MAS	5 (11.9)	1 (5.6)	6 (10.0)	0.82
Pneumonia	0 (0.0)	1 (5.6)	1 (1.7)	0.60
Fever	2 (4.8)	1 (5.6)	3 (5.0)	1.00

NNJ = neonatal jaundice; NNS = neonatal Sepsis; RDS = respiratory distress syndrome; MAS = meconium aspiration syndrome; HVS = high vaginal swab

Table 3 evaluates frequency distribution of antibiotics according to sensitivity pattern for organism (all taken together), isolated in high vaginal swab culture. Overall, most HVS culture positive microorganisms were sensitive to antibiotics as follows. Maximum sensitivity observed with cefepime (12, 66.7%), cefuroxime (10, 55.6%), cefalexin (9, 50.0%), cotrimoxazole (8, 44.0%), vancomycin (8, 44.0%) followed by ampicillin, lincomycin, penicillin, ceftazidime, clindamycin (7,38.9%) and minimum sensitivity observed with linezolid and teicoplanin of about 5.6% followed by nitrofurantoin of about 0.0%. Maximum resistance

observed with cotrimoxazole (6, 33.3%), amoxiclav (6, 33.3%), ceftazidime (5, 27.8%), ciprofloxacin (5, 27.8%), roxithromycin (5, 27.8%). least resistance observed with amikacin, nitrofurantoin, vancomycin, penicillin, teicoplanin, clotrimazole, doxycycline, fluconazole of about 0.0%.

Table 4 evaluates the association between high vaginal swab culture and maternal complications and type of delivery, which did not show statistically significant association.

Regarding intrapartum (IP) complications, among 25 cases only 6 cases observed positive for HVS. Overall, 16 cases of foetal distress total 4 cases observed positive for HVS (GTI). Overall, among 6 cases of MSL only 1 case was observed positive for HVS (GTI). Among 3 cases of Severe oligo sec to PPROM only 1 case was positive for HVS (GTI).

Regarding postpartum (PP) complications, among 13cases only 3cases observed positive for HVS. Among 9 cases of PPH 2 cases observed positive for HVS (GTI) and 1 case of Adherent placenta was observed positive for HVS (GTI). 1 case of perineal tear, 1 case of puerperal fever and 1 case of retained placenta were negative for HVS (GTI).

No significant association was observed between HVS and different neonatal complications (Table 5).

Table 6 evaluates the statistical significance between high vaginal swab (HVS) and neonatal death among preterm and PPROM, which is not statistically significant (P=0.972).

Table 6: Association between HVS and neonatal death.

Neonatal death	HVS			P value
	Sterile (%)	Positive (%)	Total (%)	
Yes	2 (2.1)	0 (7.7)	2 (3.3)	0.972
No	40 (97.9)	18 (92.3)	58 (96.7)	
Total	42 (100.0)	18 (100.0)	60 (100.0)	

HVS = High vaginal swab

DISCUSSION

In the present study, various microorganisms isolated in high vaginal swabs of the studied patients, a higher value was observed on CoNS (8, 13.33%) followed by *Candida sp*. (5, 8.33%) and *Klebsiella sp*. (3, 5.00%) while lower value was observed for *Pseudomonas sp*. and *E. coli* (1, 1.67%) among total studied patients. Patel et al observed different microorganisms viz. *Escherichia coli* (6.0%), *Klebsiella pneumoniae* (0.0%), *Streptococcus agalactiae* (2.0%), *Candida albicans* (14.0%) and *Gardnerella vaginalis* (16.0%) in vaginal swab of preterm women.[13] On the other hand, Shivaraju et al documented that CoNS (23.4%) were the commonest isolated organism grown followed by candida (7.8%) and *Klebsiella*, *Pseudomonas* Enterococci and *E. coli* (3.1% in each case) followed by *Staphylococcus aureus*, Streptococcus, MRSA and *Proteus mirabilis* (1.6% in each case) were observed lower frequency in vaginal swabs for preterm and PPROM women.[10] Singh et al reported regarding the most common organism in preterm pregnancy is the *E. coli* (34.0%) followed by *Candidia spp*. (21.0%) as well as *Enterococci* (10.0%), *Staphylococci* (8.0%) and *Gardenerella vaginalis* (7.0%), respectively. Eventually, group B *Streptococcus* of about 5.0% was recorded in the genital tract of preterm pregnant women (28-37 weeks) gestation.[14] Saghafi et al reported most common isolated microorganism of endocervical culture were *Escherichia coli* (24.2%), coagulase negative *Staphylococci* (27.2%), *Enterococcus* and candida each one (11.7%) among PPROM women.[15] As per the report of Yarlagadda et al, vaginal infection was observed of about 33.62% in preterm labour patients and candida was found the common microorganism (31.03%) and other types, viz. *Staphylococcus aureus* and mixed microbes isolated in HVS cultures.[16]

In the present study, most HVS culture positive microorganisms were sensitive to antibiotics as follows. Maximum sensitivity observed with cefepime (12, 66.7%), cefuroxime (10, 55.6%), cefalexin (9, 50.0%), cotrimoxazole (8, 44.0%), vancomycin (8, 44.0%) followed by ampicillin, lincomycin, penicillin, ceftazidime, clindamycin (7,38.9%) and minimum sensitivity observed with linezolid and teicoplanin of about 5.6% followed by nitrofurantoin of about 0.0%. Maximum resistance observed with cotrimoxazole (6, 33.3%), amoxiclav (6, 33.3%), ceftazidime (5, 27.8%), ciprofloxacin (5, 27.8%), roxithromycin (5, 27.8%). least resistance observed with amikacin, nitrofurantoin, vancomycin, penicillin, teicoplanin, clotrimazole, doxycycline, fluconazole of about 0.0%. An earlier study by Shivaraju et al revealed that the antibiotics such as ampicillin (67.5%) taxim (17.5%) gentamycin (15%) were found more sensitive CoNS and *E. coli* present in HVS and occurred in preterm births and PPROM.[10] Singh et al reported that in the antibiogram study and isolate contained *E. coli*, which was showed highly sensitive to linezolid and vancomycin 100.0% in each case followed by amikacin 90.0% then cefoperazone, sulbactam and nitrofurantoin 80.0% in each case while showed resistance to cefotaxime 80% and amoxicillin and clavunate 70.0%.[14] In the case of *Staphylococcus aureus*, linezolid and vancomycin 100.0% in each case and were more sensitive than cefotaxime 90.0% followed by clindamycin 80.0% and nitrofurantoin 60.0%, respectively. This was mostly resistance to amoxicillin and clavunate of about 60.0%. For *Enterococcus* species, it was noted that sensitive to vancomycin 100.0%, amoxicillin and clavunate 90.0% followed by amikacin 90.0% and highly resistant to ampicillin 100.0%, respectively. The isolated organism like GBS was highly sensitive to gentamycin 100.0% followed by clindamycin 80.0% than cefotaxime 60.0%, respectively. This was highly resistant to nitrofurantoin

60.0%. The organism *Gardenerella vaginalis* highly sensitive to metronidazole 100.0% followed by ampicillin 90.0% than gentamycin 80.0%, respectively.

In the present study, no significant association was observed between HVS and different maternal complications and type of delivery. On the other hand, no significant association was observed between HVS and different neonatal complications. In an earlier study conducted by Seshasai and Sukanya and they observed different neonatal complications such as RDS 11.48%, neonatal sepsis (NNS) 1.64%, MAS 0.82%, birth asphyxia (BA) 2.46%, NC 0.82%.[9] Neonatal death was seen in 14 neonates (11.48%) out of 122 births. According to Khade and Bava, about 69.7% were observed hyperbilirubinemia (NNJ), 30.3% sepsis (NNS) and 63.6% RDS, respectively in PPROM.[11] An earlier study by Shivaraju et al, it observed different neonatal complications such as RDS 7.35%, neonatal sepsis (NNS) 2.94%, MAS 1.47%, birth asphyxia (BA) 2.94%.[10] In earlier study by Satija et al reported different neonatal complications such as NNJ 28.44%, RDS 15.6%, neonatal sepsis (NNS) 12.84%, congenital pneumonia (CP) 0.092%.[17]

In the present study, evaluation between high vaginal swab (HVS) and neonatal death among preterm and PPROM, did not show statistically significant (p=0.972) change. In an earlier study conducted by Seshasai and Sukanya neonatal death was seen in 14 neonates (11.48%) out of 122 births.[9] According to Khade and Bava, observed perinatal mortality was 15.0%.[11] Major cause was observed respiratory distress syndrome (53.0%) followed by sepsis (26.7%) and birth asphyxia (20%). They observed perinatal mortality was 15.0%. Major cause was observed respiratory distress syndrome (53.0%) followed by sepsis (26.7%) and birth asphyxia (20%). An earlier study by Shivaraju et al it was observed different neonatal death of about 1.47%.[10]

CONCLUSION

It is concluded that PTL and PPROM are the important causes of preterm birth that can be resulted high neonatal morbidity and mortality. Moreover, GTI is significant causative factors of PTL and PPROM. In this context, it is always advisable to screen and monitor the antenatal women for the presence of asymptomatic GTI infections. Early diagnosis and prompt treatment of GTI help in the prevention of PTL and PPROM, which ultimately prevent the associated neonatal morbidity and mortality of premature babies.

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