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VAGINAL INFECTION AND ITS RELATION TO PRETERM LABOUR, PRETERM PRELABOUR RUPTURE OF MEMBRANES AND ADVERSE PREGNANCY OUTCOME: A PROSPECTIVE OBSERVATIONAL STUDY

Obstetrics & Gynaecology

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ABSTRACT

Background: Preterm labour and preterm prelabour rupture of membranes (PPROM) are important causes of adverse maternal and neonatal outcomes. Ascending vaginal infection may contribute to membrane weakening, inflammatory activation and early labour. This study was aimed to assess the relation of vaginal infections with PPROM and preterm labour and to evaluate maternal and perinatal outcomes. **Methods:** In this prospective observational study, 104 pregnant women with singleton live fetus between 28 and 37 weeks of gestation admitted to the labour room were included after applying predefined inclusion and exclusion criteria. High vaginal swabs were collected from the posterior fornix under direct vision and subjected to culture and sensitivity. Participants were grouped according to vaginal infection status and clinical diagnosis. **Results:** The mean age of the study population was 24.43 ± 3.63 years and the mean period of gestation was 32.59 ± 1.94 weeks. Vaginal infection was detected in 53 (51.0%) women. Infection was significantly more common in PPROM than in preterm labour with intact membranes [34/52 (65.4%) vs 19/52 (36.5%), p=0.003; OR 3.28 (1.47-7.32)]. Coagulase-negative Staphylococci were the commonest isolates followed by Candida albicans and Escherichia coli. Infection-positive women had lower gestational age at delivery, lower birth weight, longer hospital stay and higher rates of LSCS, maternal adverse outcome, NICU admission, respiratory distress syndrome and neonatal sepsis. **Conclusion:** Vaginal infection was significantly associated with PPROM and adverse maternal and perinatal outcomes in this study. Routine clinical vigilance, timely diagnosis and appropriate treatment of vaginal infections may help reduce preventable morbidity in women at risk of preterm birth.

KEYWORDS

INTRODUCTION:

Preterm labour is defined as labour occurring before 37 completed weeks of gestation. Preterm prelabour rupture of membranes (PPROM) refers to spontaneous rupture of membranes before the onset of regular uterine contractions in the preterm period (1). Preterm birth remains a major contributor to perinatal morbidity and mortality, particularly through respiratory distress syndrome, neonatal sepsis, low birth weight, need for neonatal intensive care and perinatal death (2).

Vaginal and lower genital tract infections are biologically plausible contributors to PPROM and preterm birth. Infection and inflammation are recognised components of the preterm parturition syndrome (3). Microbial endotoxins and inflammatory cytokines such as interleukin-1 beta, interleukin-8 and tumour necrosis factor-alpha can stimulate prostaglandin production and matrix-degrading enzymes. Increased metalloproteinase activity results in collagen degradation and reduction in tensile strength of fetal membranes, predisposing to membrane rupture and preterm delivery. Bacterial vaginosis has also been reported as an important risk factor for preterm delivery (4).

Previous studies have reported that vaginal infection and genitourinary infection are associated with preterm labour, PPROM and adverse neonatal outcome. Shivaraju et al. reported high vaginal swab growth in half of the women studied, with coagulase-negative Staphylococci and Candida as frequent isolates (5). Mohammed and Heraiz reported that bacterial vaginosis and aerobic vaginitis were associated with PPROM and adverse pregnancy outcome (6). D'souza et al. observed that genitourinary infections were significantly associated with PPROM in a hospital-based case-control study (7). Therefore, the present study was conducted to assess the relation of vaginal infection with PPROM and preterm labour and to evaluate associated maternal and perinatal outcomes.

Materials and methods

Study population:

This prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Ballari Medical College and Research Centre, Ballari. A total of 104 women admitted in the labour room with diagnosis of PPROM or preterm labour with intact membranes were included after application of inclusion and exclusion criteria. The study population included pregnant women with singleton live fetus at 28-37 weeks of gestation as per corrected expected date of delivery.

PPROM was defined by history of sudden gush of fluid with continued leakage and evidence of fluid pooling in the vagina or leakage from the cervical os when the patient coughed or when fundal pressure was applied. Women who did not consent, women with antepartum haemorrhage, multiple gestation, polyhydramnios, structural or functional abnormality of uterus or cervix, recent diarrhoeal or urinary tract infection, sexual intercourse within the preceding 24 hours, vaginal bleeding or antibiotic use within the previous four weeks were excluded.

Written informed consent was obtained from all participants and confidentiality was maintained. The study was planned according to institutional ethics committee requirements.

Sample collection and microbiological assessment:

High vaginal swab samples were collected from the posterior fornix under direct vision using Cusco/Sims speculum. Samples were subjected to culture and sensitivity testing. Culture growth was considered evidence of vaginal infection, while sterile culture/no growth was considered infection negative. Isolated organisms and antibiotic sensitivity patterns were recorded.

Maternal and perinatal outcomes:

Maternal variables included age, obstetric profile, booking status, gestational age, laboratory parameters, diagnosis group, management, mode of delivery, LSCS indication, maternal fever, chorioamnionitis, abruption, postpartum haemorrhage, maternal sepsis and duration of hospital stay. Perinatal variables included baby sex, birth weight, live status, Apgar score, immediate cry, resuscitation, NICU admission, respiratory distress syndrome, neonatal sepsis and neonatal death. Composite maternal adverse outcome and composite perinatal adverse outcome were derived from the recorded complications.

Statistical analysis:

Data were entered in Microsoft Excel and analysed using descriptive and inferential statistics. Continuous variables were expressed as mean ± standard deviation with range. Categorical variables were expressed as frequencies and percentages. Association between categorical variables was assessed using Chi-square test or Fisher exact test as appropriate. Continuous variables between infection-positive and infection-negative groups were compared using independent samples t-test. A p value less than 0.05 was considered statistically significant.

RESULTS

Sociodemographic and obstetric characteristics:

The study included 104 pregnant women. The mean age was 24.43 ± 3.63 years (range 18-33 years), and the mean period of gestation at admission/delivery was 32.59 ± 1.94 weeks (range 28-36 weeks).

Primigravidae constituted 48 (46.2%) of the study population and 77 (74.0%) women were booked. PPROM and preterm labour with intact membranes each accounted for 52 cases (50.0%). Vaginal infection was detected in 53 (51.0%) women, while 51 (49.0%) had sterile/no growth on culture. Baseline characteristics according to infection status are shown in Table I.

Table I: Baseline clinical characteristics according to vaginal infection status.

Variable	Infection positive (n=53)	Infection negative (n=51)	p value
Age, years	24.57 ± 3.71	24.29 ± 3.57	0.704
POG, weeks	31.94 ± 1.89	33.25 ± 1.78	<0.001
Hb, g/dL	10.72 ± 1.35	11.00 ± 1.05	0.225
TLC, cells/cumm	11484.70 ± 2350.68	10383.22 ± 2235.22	0.016
Birth weight, kg	1.80 ± 0.41	2.10 ± 0.44	<0.001
Hospital stay, days	8.49 ± 1.50	5.35 ± 1.66	<0.001

Vaginal infection and diagnosis group:

Vaginal infection was significantly more frequent among women with PPROM when compared with women having preterm labour with intact membranes. Among PPROM cases, 34/52 (65.4%) were infection positive, whereas among preterm labour with intact membranes, 19/52 (36.5%) were infection positive (p=0.003). The odds of PPROM were higher in women with vaginal infection [OR 3.28 (1.47-7.32)]. The distribution is shown in Table II.

Table II: Relation of vaginal infection with PPROM and preterm labour.

Diagnosis group	Infection positive	Infection negative	Total	Infection rate	p value
PPROM	34	18	52	65.4%	0.003
Preterm labour with intact membranes	19	33	52	36.5%	
Total	53	51	104	51.0%	

Microbiological profile:

Among the 53 culture-positive women, coagulase-negative Staphylococci were the commonest isolates (16 cases; 30.2% of positives), followed by Candida albicans (12 cases; 22.6%), Escherichia coli (9 cases; 17.0%), Streptococcus agalactiae (7 cases; 13.2%), bacterial vaginosis/mixed anaerobes (6 cases; 11.3%) and Klebsiella pneumoniae (3 cases; 5.7%).

Table III: High vaginal swab culture profile.

Organism isolated	Count	% of total sample	% of culture positives
CONS	16	15.4%	30.2%
Candida albicans	12	11.5%	22.6%
Escherichia coli	9	8.7%	17.0%
Bacterial vaginosis / mixed anaerobes	6	5.8%	11.3%
Streptococcus agalactiae	7	6.7%	13.2%
Klebsiella pneumoniae	3	2.9%	5.7%
No growth / sterile	51	49.0%	-

Mode of delivery and maternal outcomes:

Overall, 78 women (75.0%) delivered vaginally, 3 (2.9%) had instrumental vaginal delivery and 23 (22.1%) underwent LSCS. LSCS was more frequent among infection-positive women than infection-negative women [17/53 (32.1%) vs 6/51 (11.8%), p=0.013]. Composite maternal adverse outcome occurred in 20/53 (37.7%) infection-positive women compared with 7/51 (13.7%) infection-negative women (p=0.005).

Perinatal outcomes:

The mean birth weight was significantly lower in the infection-positive group (1.80 ± 0.41 kg) compared with the infection-negative group (2.10 ± 0.44 kg; p=<0.001). Composite perinatal adverse outcome was more common in infection-positive women [29/53 (54.7%)] than in infection-negative women [17/51 (33.3%); p=0.028]. NICU admission, RDS and neonatal sepsis were also significantly higher among infection-positive women. Maternal and perinatal outcome distribution is shown in Table IV.

Table IV: Maternal and perinatal outcomes according to vaginal infection status.

Outcome	Infection positive (n=53)	Infection negative (n=51)	Odds ratio (95% CI)	p value
LSCS	17 (32.1%)	6 (11.8%)	3.54 (1.27-9.91)	0.013
Maternal adverse outcome	20 (37.7%)	7 (13.7%)	3.81 (1.44-10.07)	0.005
Maternal fever	10 (18.9%)	3 (5.9%)	3.72 (0.96-14.41)	0.045
Chorioamnionitis	9 (17.0%)	2 (3.9%)	5.01 (1.03-24.46)	0.030
Postpartum haemorrhage	4 (7.5%)	1 (2.0%)	4.08 (0.44-37.83)	0.363
Abruption	3 (5.7%)	1 (2.0%)	3.00 (0.30-29.83)	0.618
Maternal sepsis	2 (3.8%)	0 (0.0%)	5.00 (0.23-106.73)	0.495
Perinatal adverse outcome	29 (54.7%)	17 (33.3%)	2.42 (1.09-5.35)	0.028
NICU admission	27 (50.9%)	16 (31.4%)	2.27 (1.02-5.06)	0.043
Respiratory distress syndrome	20 (37.7%)	9 (17.6%)	2.83 (1.14-7.02)	0.022
Neonatal sepsis	14 (26.4%)	3 (5.9%)	5.74 (1.54-21.43)	0.005
Neonatal death	4 (7.5%)	1 (2.0%)	4.08 (0.44-37.83)	0.363

DISCUSSION:

In the present prospective observational study, vaginal infection was found in 53 out of 104 women (51.0%). Infection was significantly associated with PPROM, with culture positivity in 65.4% of PPROM cases compared with 36.5% of preterm labour cases with intact membranes. This supports the hypothesis that ascending genital tract infection contributes to premature rupture of membranes through inflammatory and enzymatic pathways that weaken the fetal membranes (3).

The microbiological profile showed coagulase-negative Staphylococci as the commonest isolate, followed by Candida albicans and Escherichia coli. This pattern is comparable with the study by Shivaraju et al., where high vaginal swab growth was seen in 40 out of 80 women and coagulase-negative Staphylococci were the commonest isolates followed by Candida (5). The present findings also align with Mohammed and Heraiz, who reported that vaginal infections were associated with PPROM and adverse pregnancy outcome (6). Nguyen et al. also observed that bacterial vaginosis increased the risk of preterm labour and PPROM, while aerobic bacterial isolates were related to PPROM (9).

The association of infection with adverse maternal outcomes was clinically important. Infection-positive women had higher LSCS rates, higher composite maternal adverse outcome, longer hospital stay, and increased occurrence of inflammatory complications such as chorioamnionitis and maternal fever. These findings are biologically plausible because intrauterine and lower genital tract infection can trigger inflammatory cascades, fever, uterine activity and fetal compromise, leading to operative delivery and prolonged hospitalisation.

Perinatal outcomes were also worse among infection-positive women. Neonates born to mothers with vaginal infection had lower mean birth weight and higher rates of NICU admission, respiratory distress syndrome and neonatal sepsis. These observations are consistent with previous literature that identifies vaginal infection as a contributor to prematurity-related morbidity, neonatal infection and respiratory morbidity (8). Evidence from antibiotic trials in preterm rupture of membranes also supports the importance of infection control in reducing short-term neonatal morbidity (10).

The strengths of this study include prospective data collection, uniform inclusion criteria and microbiological assessment using high vaginal swab culture. The limitations include single-centre design, relatively modest sample size, culture-based diagnosis without molecular testing for anaerobes or atypical organisms, and the observational nature of the study, which does not establish causality. Larger multicentric studies with standardized microbiological panels and follow-up of neonatal outcomes would provide stronger evidence.

In conclusion, vaginal infection was significantly associated with PPROM, LSCS, maternal adverse outcome and adverse perinatal outcome. High vaginal swab evaluation in clinically indicated women and appropriate antimicrobial management may help reduce preventable maternal and neonatal morbidity associated with preterm birth.

Conflict of Interest:

The authors declare no conflict of interest.

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