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Original Research Article

Bacteriological assessment on urinary tract infection in preterm premature rupture of the membranes and preterm labour related to fetomaternal outcomes

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ABSTRACT

Background: Urinary tract infection (UTI) is a health hazards risk during pregnancy of mothers, which leads to preterm premature rupture of the membranes (PPROM) following preterm labour (PTL). The objective was to investigate the most common bacteria causing UTI in cases presenting with PPROM following PTL and also their sensitivity profile to antibiotics and fetomaternal outcome in such cases at tertiary care hospital, Central India.
Methods: This research was conducted a hospital-based prospective and observational study among 60 pregnant women for the period of 01 July 2020 to 30 June 2021 in the tertiary care hospital at Bhilai, Chhattisgarh. Also studied urine for culture and sensitivity test for antibiotics related to fetomaternal outcomes.
Results: Among the marker of infection of total studied patients, a maximum for UCS positive (21.7%) and WBC count >15000 cumm (15.0%) while minimum for CRP (10.0%). Among the various microorganisms isolated in urine culture of participants, a higher value was observed on *E. coli* (11.67%) followed by *Klebsiella sp.* and *Proteus sp.* (3.33%) while lower value was observed for *Pseudomonas sp.* and CoNS (1.67%) among total studied patients. The association between urine culture and maternal complications, type of delivery, did not show significant association. No significant association was observed between urine culture and different parameters of neonatal complications and neonatal death. Only two deaths of babies were recorded.
Conclusions: UTI is significant causative factors of PTL and PPROM. It is always suggested to screen and monitor the antenatal mothers for the presence of asymptomatic or symptomatic UTI.

Keywords: Antibiotic sensitivity, Bacterial infection, Maternal outcome, Neonatal complications, Preterm labour, PPROM, Urinary tract infection

INTRODUCTION

Urinary tract infection (UTI) is a common health hazards during pregnancy of mothers in India and abroad.[1,2] Generally, asymptomatic bacteriuria (ASB) cause bacterial infection within the urinary tract without signs or symptoms of urinary infection.[2] In other words, this condition is defined by the presence of ≥1 species of bacteria identified in the urine culture as positive at a qualitative and quantitative count of >105 colony-forming units (CFU/ml).[3]

In India and other parts of globe, UTI is one of the most common bacterial infections during pregnancy.[2,4] In the case of UTI, several bacteria are well known for preterm labour as per many reports. Most common uropathogens viz. *Escherichia coli*, *Klebsiella pneumonia*, *Proteus mirabilis*, *Enterobacter* sp., *Staphylococcus saprophyticus*, *Candida* sp. and group B streptococci are

found in pregnant women.[5,6] Among these, *E. coli* shows majority of subjects of about 70-90%.[7] The presence of pathogenic bacteria in the bladder of pregnant women is associated with the mass colonization of the inferior genital tract and the presence of chorioamnionitis, even when the infection is subclinical.[8]

According to Royal College of Obstetricians and Gynaecologists (RCOG), it was suggested for managing preterm labour recommend performing septic workups to recognize whether an infection is the cause of preterm labour. Moreover, urine analysis and urine culture are frequently diagnosing the UTI, despite the absence of signs and symptoms with midstream urine culture (MUC) being the gold standard.[3]

The symptomatic or asymptomatic UTI may lead to maternal and foetal complications investigated by many authors.[1-4,7] The majority of studies have been conducted in abroad and few studies are found in India related to UTI in PTL or PPROM.[1,2,4,7] Furthermore, study is lacking in the central region of India. Hence, this study was attempted to investigate the prevalence of UTI 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 conducted to evaluate the prevalence of UTI 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 Bhilai, Chhattisgarh, India. A total 60 pregnant women were enrolled, and the study period was from 01 July 2020 to 30 June 2021.

All inclusion and exclusion criteria were elaborated in an earlier study by Bargaje and Hussain.[8] The protocol for urine culture was followed as per the standard method.[3,9] The most commonly used cut-off for significant bacteriuria is ≥100,000 CFU/ml of urine sample.[9,10]

The statistical analyses were performed as per our previous study.[8] P value <0.05 was considered statistically significant.

RESULTS

Table 1 evaluates the distribution of marker of infection among patients. Among the marker of infection of participants, a maximum for UCS positive (21.7%) and WBC count >15000 cumm (15.0%) while minimum for CRP (10.0%) among mothers.

Table 2 evaluates the distribution of various microorganisms isolated in urine culture among patients. Among the various microorganisms isolated in urine culture of participants, a higher value was observed on *E. coli* (11.67%) followed by *Klebsiella sp.* and *Proteus sp.* (3.33%) while lower value was observed for *Pseudomonas sp.* and CoNS (1.67%) among total studied patients.

Table 1: Frequency distribution of marker of infection among patients.

Parameters	Frequency	Percent (%)
UCS positive (UTI)	13	21.7
CRP positive	6	10.0
WBC >15000/cumm	9	15.0

UCS=Urine culture sensitivity; UTI=urinary tract infection; CRP=C-reactive protein, WBC=white blood cell count

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

Microorganisms	Frequency	Percent (%)
E. coli	7	11.67
***Klebsiella* sp.**	2	3.33
***Proteus* sp.**	2	3.33
***Pseudomonas* sp.**	1	1.67
CoNS	1	1.67
Sterile	47	78.33

CoNS=Coagulase-negative Staphylococci

Table 3 evaluates the distribution of overall urine culture antibiotic tested sensitive and resistant pattern. Overall, most urine culture positive microorganisms were sensitive to antibiotics as follows. Maximum sensitivity observed with Gentamycin (92.3%), Cefuroxime (69.2%), Amikacin (61.5%), Cefepime (61.5%), Nitrofurantoin (53.8%), Ciprofloxacin (38.5%), Amoxiclav (38.5%), Cefalexin (30.8%), Ceftazidime (23.1%), Cotrimoxazole (23.1%), Azithromycin (7.7%), Cloxacillin (7.7%), Roxithromycin (7.7%), Linezolid (7.7%), Vancomycin (7.7) and minimum sensitivity observed with Clindamycin, Lincomycin, Penicillin, Teicoplanin of about 0.0%. Maximum resistance observed with Ampicillin (69.2%), Ciprofloxacin (38.5%), Ceftazidime (30.8%) followed by Cefuroxime, Cefalexin, Cefepime, amoxiclav of about 23.1%, followed by Nitrofurantoin (15.4%) followed by Gentamycin, Amikacin, Penicillin, Teicoplanin, Clindamycin, Lincomycin of about 7.7%. Least resistance observed with Azithromycin, Roxithromycin, Cloxacillin, Linezolid, Vancomycin of about 0.0%.

Table 4 evaluates the association between urine culture and maternal complications, type of delivery, which did not show significant association. Regarding intrapartum (IP) complications, among 25 cases only 4 cases observed positive for UCS. Overall, 16 cases of foetal distress total 3 cases observed positive for UCS (UTI). Overall, among 6 cases of MSL no case was observed positive for UCS (UTI). Among 3 cases of Severe oligo sec to PPROM only 1 case was positive for UCS (UTI). Regarding postpartum (PP) complications, among 13 cases only 2 cases observed

positive for UCS. 1 case of adherent placenta and 1 case of perineal tear was observed positive for UCS (UTI).

No case was observed positive for UCS (UTI) among 9 PPH cases, and 1 case of puerperal fever and 1 case of retained placenta.

No significant association was observed between urine culture and different parameters of neonatal complications (Table 5).

Table 6 evaluates the statistical significance between urine culture and neonatal death among preterm and PPROM which is not statistically significant (p=0.389).

Table 3: Frequency distribution of urine culture results according to antibiotics susceptibility pattern.

Antibiotics	Sensitive, n=13 (%)	Resistant, n=13 (%)	Antibiotics	Sensitive, n=13 (%)	Resistant, n=13 (%)
Amikacin	8 (61.5)	1 (7.7)	Cotrimoxazole	3 (23.1)	5 (38.5)
Ceftazidime	3 (23.1)	4 (30.8)	Azithromycin	1 (7.7)	0 (0.0)
Cefuroxime	9 (69.2)	3 (23.1)	Cloxacillin	1 (7.7)	0 (0.0)
Cefepime	8 (61.5)	3 (23.1)	Roxithromycin	1 (7.7)	0 (0.0)
Cefalexin	4 (30.8)	3 (23.1)	Linezolid	1 (7.7)	0 (0.0)
Amoxiclav	5 (38.5)	3 (23.1)	Vancomycin	1 (7.7)	0 (0.0)
Gentamycin	12 (92.3)	1 (7.7)	Clindamycin	0 (0.0)	1 (7.7)
Nitrofurantoin	7 (53.8)	2 (15.4)	Lincomycin	0 (0.0)	1 (7.7)
Ciprofloxacin	5 (38.5)	5 (38.5)	Penicillin	0 (0.0)	1 (7.7)
Ampicillin	2 (15.4)	9 (69.2)	Teicoplanin	0 (0.0)	1 (7.7)

Amoxiclav=Amoxicillin + Clavulanic acid

Table 4: Association between urine culture and maternal complications, type of delivery.

Maternal complications	Urine culture		Total	P value
	Sterile	Positive		
None (no IP complications)				
n	26	9	35	0.527
%	55.3	69.2	58.3	
Maternal complications IP (yes)				
n	21	4	25	
%	44.7	30.8	41.7	
Total, n	47	13	60	
None				
n	36	11	47	0.713
%	76.6	84.6	78.3	
Maternal complications PP (yes)				
n	11	2	13	
%	23.4	15.4	21.7	
Total				
n	47	13	60	
%	100.0	100.0	100.0	
Vaginal				
n	20	5	25	0.824
%	42.6	38.5	41.7	
Instrumental				
n	1	0	1	
%	2.1	0.0	1.7	
LSCS				
n	26	8	34	
%	55.3	61.5	56.7	
Total				
n	47	13	60	
%	100.0	100.0	100.0	

Table 5: Association between UCS and neonatal complications.

Neonatal complications	UCS		Total	P value
	Sterile	Positive		
NNJ				
n	13	4	17	1.000
%	27.7	30.8	28.3	
NNS				
n	8	3	11	0.885
%	17.0	23.1	18.3	
RDS				
n	11	5	16	0.885
%	23.4	38.5	26.7	
MAS				
n	6	0	6	
%	12.8	0.0	10.0	0.455
%	2.1	7.7	3.3	

NNJ=Neonatal jaundice; NNS=neonatal sepsis; RDS=respiratory distress syndrome; MAS=meconium aspiration syndrome; UCS=urine culture

Table 6: Association between UCS positive and neonatal death.

Neonatal death, n (%)	UCS		Total	P value
	Sterile	Positive		
No	46 (97.9)	12 (92.3)	58 (96.7)	
Yes	1 (2.1)	1 (7.7)	2 (3.3)	0.389
Total	47 (100.0)	13 (100.0)	60 (100.0)	

UCS=Urinary culture sensitivity

DISCUSSION

In the present study, UCS positive (21.7%) was an important marker of UTI compared to CRP and WBC obtained among pregnant mothers, which is supported by Vogel et al.[10] Therefore, the incidence of UTI was obtained of about 21.7% in our study while Vrishali et al reported a similar frequency (22.0%) of UTI among pregnant mothers.[11]

Among the various microorganisms isolated in urine culture, a higher value was observed on *E. coli* (11.67%) followed by *Klebsiella* sp. and *Proteus* sp. (3.33%) while lower value was observed for *Pseudomonas* sp. and CoNS (1.67%) among total studied women. An earlier study by Yarlagadda et al reported that UTI was most prevalent of about 27.58% cases and *E. coli* was the most common microorganism found in the urine culture of about 15.51% while *Klebsiella sp., Candida sp.,* Acinetobacter and *Staphylococcus aureus* were reported 3.44%, 2.58%, 0.86% and 5.17%, respectively among patients of preterm labour.[12] Dheepthambiga et al also reported that the prevalence of UTI in preterm labour was 30.1%, common organism was *E. coli* about 69.0% accounted in the urine sample, followed by CoNS 10.8%, *Staphylococcus aureus* 10.8% and *Klebsiella* sp 3.8%.[13] The most common organism was *E. coli* for positive urine culture as per the investigation by Talungchit et al.[1]

In our study, maximum sensitivity observed with Gentamycin (92.3%), Cefuroxime (69.2%), Amikacin (61.5%), Cefepime (61.5%), Nitrofurantoin (53.8%), Ciprofloxacin (38.5%), Amoxiclav (38.5%), Cefalexin (30.8%), Ceftazidime (23.1%), Cotrimoxazole (23.1%), Azithromycin (7.7%), Cloxacillin (7.7%), Roxithromycin (7.7%), Linezolid (7.7%), Vancomycin (7.7) and minimum sensitivity observed with Clindamycin, Lincomycin, Penicillin, Teicoplanin of about 0.0%. Singh et al observed antibiotic sensitivity as Linezolid and Vancomycin (100%), Amikacin (90%) Cefoperazone and Sulbactam and Nitrofurantoin (80%) for *E. coli* while Amikacin and Imipenem for *Klebsiella* sp. and Gentamycin, Ciprofloxacin and Imipenem for *S. aureus*.[14] Talungchit et al obtained *E. coli* (40.0%) was the most common organism identified in urine culture of pregnant mothers.[1] According to a recent study by Kerure et al, *E. coli* was most commonly observed organism in 13 patients (38%), followed by *Klebsiella* sp. (24.0%) while *Proteus* organism (17.0%), *Pseudomonas aeruginosa* (12.0%) and *S. aureus* (9.0%) were noted.[2]

In our study, the association between urine culture and maternal complications, type of delivery, did not show significant association. No significant association was observed between urine culture and different parameters of neonatal complications. A close similarity is found with the previous studies. In earlier study by Satija et al reported that women had multiple risk factors such as UTI (20%), vaginal infections (26%), fever (pyrexia) (10%) previous preterm delivery (12%) and threatened abortion (6%).[15] In earlier study by Amulya et al reported that patients had multiple risk factors such as UTI (21.1%), vaginal infections (16.6%), fever (pyrexia) (10%) previous preterm delivery (11.1%) and threatened abortion (4.4%).[16] Mahor et al evaluated the incidence of UTI was higher among the pregnant women where anaemia, PIH, chorioamnionitis and puerperalpyrexia of about 21.6%, 21.7%, 18.2% and 23.5%, respectively.[17] Recently, Kerure et al reported that maternal outcome of UTI (12.0%) in pregnant mothers in which abortions, anaemia, puerperal pyrexia, PIH, chorioamnionitis and 12.0%, 26%, 23%, 12.0%, 9.0%, respectively while 6% of mothers developed PPROM, recurrent UTI and preterm labour.[2]

Regarding neonatal outcome, only death was recorded among two babies (3.33%) in the present study. Mahor et al reported preterm birth (24.4%) and perinatal mortality (16.7%) while they reported no association of the incidence of UTI with FGR.[17] Satija et al reported different neonatal complications such as NNJ 28.44%, RDS 15.6%, neonatal sepsis (NNS) 12.84%, and congenital pneumonia (CP) 0.092%.[18]

CONCLUSION

It is concluded that PTL and PPROM are the important causes of preterm birth that can be impacted on maternal and neonatal complications. Moreover, UTI 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 UTI. Early diagnosis and prompt treatment of UTI help in the mitigation of PTL and PPROM, which ultimately prevent the associated maternal and neonatal complications among pregnant mothers.

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