



“ASSESSMENT OF MATERNAL OUTCOMES SECONDARY TO SYMPTOMATIC URINARY TRACT INFECTION IN PREGNANCY”

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Abstract-

Background- The prevalence of bacteriuria is the same in pregnant and non-pregnant women. Pregnant women are at the risk of recurrent bacteriuria. Without treatment, 30 to 40% of these pregnant women will develop symptomatic UTI. Urinary tract infection (UTI) is a widely prevalent problem in developing countries like India. This leads to adverse maternal and fetal outcomes, which could have been avoided by preventing the urinary tract infection. Despite increase in hospital-based ante-natal checkups and more deliveries in hospital than at home which has significantly reduced maternal and fetal morbidity and mortality, maternal and fetal deaths due to complications from urinary tractinfection still occur which should ideally be prevented.

Aim - “Assessment of maternal outcomes secondary to symptomatic urinary tract infection in pregnancy”.

Methods and materials: This is a prospective cohort study which was done in the department of pediatrics Medicine and Obstetrics and Gynecology at Mahatma Gandhi Memorial Medical college and associated hospital Indore from January 2021 to January 2023. Pregnant women who were booked in my hospital for their antenatal care were included in the study. Pregnant women with symptomatic urinary tract infection with significant growth in urinary culture were taken as cases and others were taken as controls. Maternal outcomes were assessed at delivery. Comparison of quantitative variables were done using independent t-test or Wilcoxon rank sum test. Comparison of categorical variables were done using Fisher’s Exact test. All significant variables were analysed using logistic regression.

Results and conclusion- In our study preterm premature rupture of membranes was more among the case than controls with OR of 2.697 which was statistically significant (95% CI- 1.423- 5.11, p=0.001) Preterm delivery and post-partum sepsis were also statistically significant with OR of 3.162 and 3.972 respectively. Primigravida, multifetal pregnancy, low maternal education, past history of catheterization, urinary tract infection, and anemia were statistically significant risk factors for the development of urinary tract infection.

Keywords- urinary tract infection, preterm delivery, premature rupture of membrane, post-partum sepsis.

Introduction-

The prevalence of bacteriuria is the same in pregnant and non-pregnant women. Pregnant women are at the risk of recurrent bacteriuria. Without treatment, 30 to 40% of these pregnant women will develop symptomatic UTI. By treating asymptomatic bacteriuria in pregnant women, the risk of developing symptomatic UTI can be reduced by 70 to 80% (1). Asymptomatic bacteriuria and symptomatic urinary tract infection are associated with adverse maternal and fetal outcomes such as preterm birth, low birth weight infant, perinatal mortality, sepsis (1,2).

Urinary tract infection (UTI) is a widely prevalent problem in developing countries like India. The prevalence of urinary tract infection is higher in the pregnant women due to the physiological changes that occur in the urinary tract during pregnancy. This leads to adverse maternal and fetal outcomes, which could have been avoided by preventing the urinary tract infection. Despite increase in hospital-based ante-natal checkups and more deliveries in hospital than at home which has significantly reduced maternal and fetal morbidity and mortality, maternal and fetal deaths due to complications from urinary tract infection still occur which should ideally be prevented.

The data from western population shows that the incidence of urinary tract infections is higher in pregnant women and it correlates with adverse maternal and fetal outcomes and it can be prevented by screening for asymptomatic bacteriuria. With increasing incidence of extended spectrum beta lactamase (ESBL) infections in the community, cost of treating a urinary tract infection is significantly higher than screening and treating for asymptomatic bacteriuria.

Aims- The aim of the study is to assess maternal outcomes occur secondary to symptomatic urinary tract infection in pregnancy.

Materials and methods- This is a prospective cohort study which was done in the department of pediatrics Medicine and Obstetrics and Gynecology at Mahatma Gandhi Memorial Medical college and associated hospital Indore from January 2021 to January 2023. Pregnant women who were booked in my hospital for their antenatal care were included in the study. Pregnant women with symptomatic urinary tract infection with significant growth in urinary culture were taken as cases and others were taken as controls, after obtaining approval from the institutional research board.

Study design- This is a prospective cohort study which was done in the department of pediatrics Medicine and Obstetrics and Gynecology at Mahatma Gandhi Memorial Medical college and associated hospital Indore from January 2021 to January 2023.

Participants- Pregnant women with symptomatic urinary tract infection with culture confirmed infection were recruited as cases. Controls were pregnant women without symptomatic urinary tract infection who delivered in our hospitals.

All pregnant women who visit our hospital, undergo regular antenatal check up with the following tests

Clinical parameters

- a. Heart rate of mother
- b. Blood pressure of mother
- c. Size of uterus
- d. Fetal movements
- e. Fetal heart sound

Laboratory parameters

- a. Haemoglobin
- b. Urine routine
- c. Urine culture
- d. OGTT
- e. VDRL
- f. Fetal ultrasound
- g. Urine albumin

Inclusion criteria for this study-

- Pregnant women more than 18 years of age.
- Should have received antenatal care from our hospital (3 visits before labour).
- Should have delivered in labour room.
- Should give informed consent.

Exclusion criteria of this study.

- Participants who do not give informed consent.
- Participants who are not booked for antenatal care.

STUDY PROCEDURE:

Patients were then interviewed during their stay in hospital for risk factors that predispose to UTI. The fetal and maternal outcomes as pre-specified were collected from the patient's chart and the data entry forms were filled. The data from Clinical microbiology on urine and blood culture characteristics were collected for assessing the antimicrobial susceptibility pattern.

Cases were pregnant women who delivered in our hospital with past history of urinary tract infection during the antenatal period with urine culture showing more than 100,000 CFU/ml of pathogenic organisms in mid-stream clean catch urine specimen or more than 100 CFU/ml in catheter sample. Pregnant women without symptomatic urinary tract infection who delivered, was recruited as controls.

SAMPLE SIZE

The required sample size to find the maternal and neonatal outcomes due to UTI during pregnancy was found to be about 200 UTI and 400 non-UTI subjects with 80% power and 5% level of significance with an anticipated proportion of 8% preterm delivery among UTI women.

STATISTICAL ANALYSIS:

Data entry was done using EPIDATA Software 3.1. Statistical analysis was done SPSS version 24. The quantitative variables were birth weight of the baby, gestational age of the mother, age of the mother. These variables were expressed in terms of mean with standard deviation (SD) or median with Interquartile range (IQR) based on the distribution of the variables in each group. The comparison of the quantitative variables was done using independent t-test or Wilcoxon rank sum test depending on the distribution. The categorical variables like preterm delivery, IUGR, pre-eclampsia, etc., were expressed as frequencies across the UTI and non-UTI subjects. Comparison of these variables across the groups were done using Fisher's Exact test. All significant variables in the above analysis were analysed using Logistic regression and P value < 0.05 was considered as statistical significance. Hosmer Lemeshow statistic were reported to assess the goodness of fit of the final model.

The study design and methods were approved by the institutional review board (blue) and ethics committee of MGM medical college.

RESULTS

This is a prospective cohort study which was done in the department of pediatrics Medicine and Obstetrics and Gynecology at Mahatma Gandhi Memorial Medical college and associated hospital Indore from January 2021 to January 2023. Four hundred and ten patients (N= 410) patients were included in the final analysis, 202 were cases and 208 were controls.

-Mean age of the study population was 26.44, with median of 26 (IQR: 18– 45) years.

-Elderly gravida with respect to risk of urinary tract infection in elderly women. There was no statistically significant difference between the two groups.

-Similarly, teenage pregnancy is associated with adverse maternal and fetal outcomes, when we looked at the same with respect to risk of urinary tract infection. There was no statistically significant difference between the two groups.

-Primigravida patients had increased risk of urinary tract infection with OR of 1.458 and P value which was statistically significant.

-Multifetal pregnancy can be associated with more adverse maternal and fetal outcomes and increased risk of urinary tract infection. The table below showed the increased risk of urinary tract infection in multifetal pregnancy with odds ratio of 8.53 (95% CI 1.05-68.8) which was statistically significant ($p < 0.05$) (45).

-This study showed that urinary tract infection occurred most commonly in the third trimester (64.9%) followed by second trimester (24.3%).

-5% of the participants conceived following fertility treatment. The risk of urinary tract infection following assisted reproduction was looked at. There was no statistically significant risk of urinary tract infection following conception after fertility treatment.

-There was no statistically significant association between abortion and risk of urinary tract infection.

-Low level of maternal education is associated with adverse maternal and fetal outcomes and increased risk of urinary tract infection as shown by OR of 1.83 (95% CI 1.03 – 3.24, $p < 0.05$).

-Participants were categorized as low SES which included participants falling into upper lower, lower middle and upper middle. High SES included participants who belonged to upper SES status as per Kuppaswamy score. There was no statistically significant association between SES score and risk of urinary tract infection.

-There was a total of 15 patients with genitourinary abnormality. The most common was renal calculi with hydronephrosis, followed by fibroid uterus, bicornuate uterus, unicornuate uterus and vaginal stenosis. 9 of these had urinary tract infections and 6 did not have urinary tract infection. There was no statistically significant association between genitourinary abnormality and risk of urinary tract infection.

Graph no-1

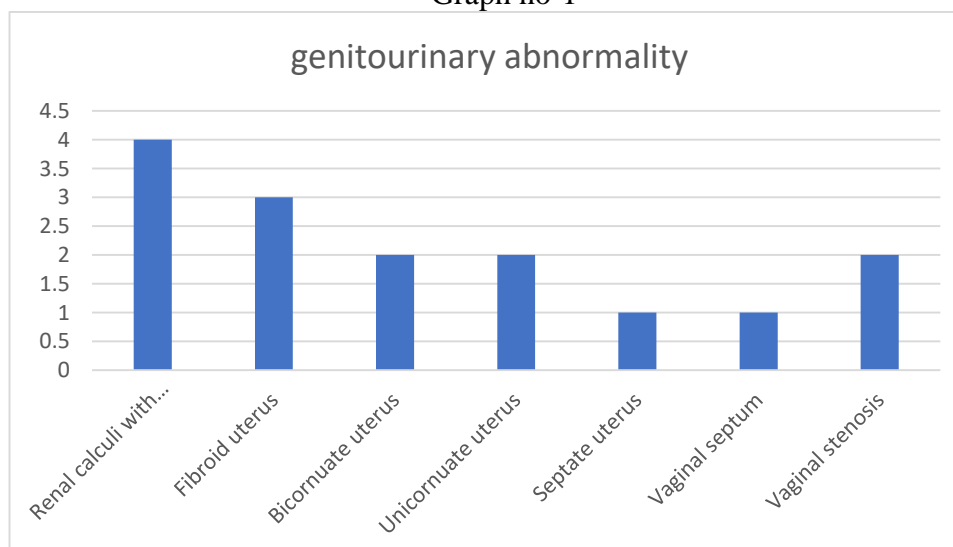


Table 1: Genitourinary abnormalities

Genitourinary abnormality	Number
Renal calculi with Hydroureteronephrosis	4
Fibroid uterus	3
Bicornuate uterus	2
Unicornuate uterus	2
Septate uterus	1
Vaginal septum	1
Vaginal stenosis	2
Total	15

-A total of 34 patients had past history of urinary tract infection. Of these, 24 were cases and 10 were controls. Past history of catheterization was associated with increased risk of urinary tract infection with an odds ratio of 2.670 (95% CI 1.24- 5.737, $p= 0.007$).

-There were 4 patients with past history of urinary tract infection. All four patients developed symptomatic urinary tract infection during the antenatal period. This was statistically significant ($p= 0.058$)

-There were 49 patients with GDM in the cases and 53 patients in the controls. There was no statistically significant risk of urinary tract infection in pregnant women with GDM.

-The number of participants with pregestational diabetes mellitus was 6 which was 1.5% of the participants studied. There was no statistically significant increase in urinary tract infection among pregnant women with pregestational DM.

-There were only 3 cases and 5 controls with chronic hypertension. There was no statistically significant increase in urinary tract infection risk among cases and controls with chronic hypertension.

-Anemia during pregnancy is associated with adverse outcomes. Anemia is associated with urinary tract infection with Odds ratio of 1.48 which was statistically significant ($p= 0.05$).

MATERNAL OUTCOMES

Urinary tract infection can be associated with adverse maternal outcomes such as premature delivery, low birth weight infants, placental abruption, pre-eclampsia, premature rupture of membranes, preterm premature rupture of membranes, chorioamnionitis, and renal complications like pyelonephritis, LSCS.

Placental abruption- placental abruption occurred in 2.5% of pregnant women with UTI and 1.9 % of women without UTI. The difference was not statistically significant ($p=0.482$).

Gestational Hypertension and mild pre-eclampsia- Gestational hypertension and mild pre – eclampsia occurred in 6.4% women with UTI versus 4.3% women without UTI. The difference was not statistically significant ($p=0.234$).

Severe preeclampsia to eclampsia- severe pre-eclampsia to eclampsia occurred in 5.4% women with UTI versus 4.8% women without UTI. The difference was not statistically significant ($p=0.472$).

Premature rupture of membranes- premature rupture of membranes occurred in 2.0% women with UTI versus 3.8 % women without UTI. The difference was not statistically significant ($p=0.205$).

Preterm premature rupture of membranes- preterm premature rupture of membranes occurred in 17.3% women with UTI versus 7.2 % women without UTI. The difference was statistically significant ($p=0.001$).

Preterm delivery- preterm labor occurred in 28.2 % women with UTI versus 11.1 % women without UTI. The difference was statistically significant ($p<0.05$).

Chorioamnionitis- There were four cases of chorioamnionitis which occurred among the cases. There were no cases of chorioamnionitis among the controls. This showed that urinary tract infection during pregnancy predisposed the patient to chorioamnionitis which was statistically significant. ($p < 0.05$).

Pyelonephritis- There were 17 cases of pyelonephritis among the cases. There were no cases of pyelonephritis among the controls. Of these 17 cases, 8 had positive growth on blood culture, 4 patients had renal angle tenderness, and 5 patients fulfilled criteria for systemic inflammatory response syndrome. This showed that there was increased incidence of pyelonephritis among the cases as compared to the controls which was statistically significant ($p < 0.05$).

Postpartum sepsis- postpartum sepsis occurred in 8.9 % women with UTI versus 2.4 % women without UTI. The difference was statistically significant ($p = 0.003$).

Intrauterine growth restriction (IUGR)- IUGR occurred in 18.3 % women with UTI versus 11.7% women without UTI. The difference was statistically significant ($p = 0.046$).

Normal versus Instrumental and Caesarean delivery- instrumental and caesarean delivery occurred in 50 % women with UTI versus 44.7 % women without UTI. The difference was not statistically significant ($p = 0.165$).

Table 2: SUMMARY OF MATERNAL OUTCOMES

	CASES	CONTROLS	OR	95% CI	P VALUE
Placental abruption	5 (2.5%)	4 (1.9%)	1.294	0.343- 4.891	0.482
Gestational hypertension to mild pre-eclampsia	13 (6.4%)	9 (4.3%)	1.521	0.635- 3.641	0.234
Severe pre eclampsia to eclampsia	11 (5.4%)	10 (4.8%)	1.140	0.473- 2.747	0.472
Premature rupture of membranes	4 (2%)	8 (3.8%)	0.505	0.150- 1.704	0.205
Preterm premature rupture of membranes	35 (17.3%)	15 (7.2%)	2.697	1.423- 5.111	0.001
Preterm delivery	57 (28.2%)	23 (11.1%)	3.162	1.860- 5.376	0.000
Postpartum sepsis	18 (8.9%)	5 (2.4%)	3.972	1.46- 10.91	0.003
Intrauterine growth restriction	34 (18.3%)	24 (11.7%)	1.697	0.959- 2.969	0.046
Instrumental and caesarean deliveries	101 (50%)	93 (44.7%)	1.237	0.839- 1.823	0.165

DISCUSSION

This is a prospective cohort study which was done in the department of pediatrics Medicine and Obstetrics and Gynecology at Mahatma Gandhi Memorial Medical college and associated hospital Indore from January 2021 to January 2023.

9 were multifetal pregnancies. This study also looked at risk factors which predisposed to urinary tract infection. Elderly gravida is associated with adverse outcomes (43). In this study there was no statistically significant increased risk of UTI in elderly gravida. This could be because there were only 14 pregnant women who were 35 years of age or older. We also looked at whether teenage pregnancy increased the risk of urinary tract infection. Teenage pregnancy is associated with numerous adverse outcomes such as preterm delivery, low birth weight and neonatal mortality as shown by Chen et al (44). There were no studies which looked at the prevalence of UTI in teenage pregnancy. Our study had 10 patients with teenage pregnancy of which 3 developed symptomatic urinary tract infection. This was not statistically significant however.

Our study also looked at parity and risk of urinary tract infection. Emiru et al had shown that parity was not statistically associated with risk of urinary tract infection (10). Our study showed that primigravida had increased risk of urinary tract infection which was statistically significant with OR of 1.458 (95% CI 0.987- 2.153, $p = 0.036$). Study done by Wing et al in 2014, showed that multiparous women had reduced incidence of urinary tract infection as compared to nulliparous women (6). This

could be attributed to the better awareness of pregnancy complications in multiparous women as compared to nulliparous women (47).

Multifetal pregnancy was associated with increased risk of urinary tract infection which was consistent with the findings of Dotters-Ketz et al in 2015 which had shown that multifetal pregnancy had increased risk of urinary tract infection with OR of 3.01 (95 % CI 2.93 to 3.09) (45). Our study showed similar findings with OR of 8.53 (95% CI of 1.05 to 68.8, $p= 0.04$). This could be explained by the higher progesterone levels in multifetal pregnancy, increase in size of the renal collecting system when compared to singleton pregnancy and by gravid uterus causing compression of the ureters which increases the risk for urinary tract infection (45).

When we looked at the incidence of urinary tract infection as per each trimester, it was seen that UTI occurred most commonly in the third trimester. This can be explained by the gravid uterus causing obstruction to the genitourinary system and hence predisposing to UTI.

Study done by Mazor-Dray et al in 2009 looked at 199,093 deliveries. This study showed that pregnant women who developed UTI had statistically significant higher number of patients who underwent fertility treatment as compared to pregnant women who did not develop UTI (41). Our study had 22 patients who conceived following fertility treatment. However, there was no statistically significant association between fertility treatment and UTI. This could be because of the lower number of pregnant women who were studied in this study. There was no association between abortion and risk of urinary tract infection.

Low maternal education is associated with adverse pregnancy outcomes as shown by study done by Muttai et al in Kenya (48). However, it did not look at urinary tract infection and association with maternal education. Emiru et al looked at education as a risk factor of UTI and found that there was no statistically significant association between the same. Wing et al showed that lower maternal education, which was defined as less than 12 years of formal education, was associated with increased risk of UTI with OR of 1.5 (95% CI 1.4- 1.7) (6). Our study done showed that low maternal education, which was defined as less than completion of high school was associated with increased risk of urinary tract infection with OR of 1.834 (95% CI 1.03- 3.24, $p < 0.05$). There was no association between low Kuppaswamy SES score and adverse maternal outcomes.

Gestational DM is associated with increased risk of urinary tract infection as shown by McMahon et al (11). Our study did not show any statistically significant association. This could be because of the early detection of GDM through universal screening, aggressive management of uncontrolled diabetes through obstetric medicine clinics and gestational DM clinics and careful follow up of patients.

Pregestational DM and chronic hypertension did not have statistically significant association with risk of urinary tract infection.

Anemia during pregnancy is associated with adverse outcomes. Anemia increases the risk of urinary tract infection has been shown by Schieve et al in 1994 (49). Our study showed that hemoglobin less than 11 g/dl is associated with increased risk for urinary tract infection with OR of 1.484 (95% CI 0.973- 2.263, $p < 0.05$).

This study then looked at maternal outcomes secondary to urinary tract infection. There was increased incidence of preterm premature rupture of membranes among pregnant women with urinary tract infection as compared to pregnant women without urinary tract infection in our study and this was statistically significant with OR of 2.697 (95% CI 1.423-5.11, $p= 0.001$). Urinary tract infection predisposes to PPRM has been seen in various studies. Mazor-Dray et al in 2009 showed increased risk of PPRM in pregnant women with UTI with OR 1.5 (95% CI 1.4- 1.7) and increased incidence of preterm delivery with OR 2.1 (95% CI 1.9-2.3, $p < 0.05$) (41). There was increased incidence of preterm delivery in our study which was also statistically significant with OR of 3.162 (95% CI 1.860- 5.376, $p < 0.05$). Pregnant women with urinary tract infection also had increased incidence of post-partum sepsis (OR 3.972, 95% CI 1.446- 10.912, $p= 0.003$) and intrauterine growth restriction (OR 1.697, 95% CI 0.959- 2.969, $p=0.046$) which were all statistically significant and similar to study findings of Mazor-Dray et al (41). There was no statistically significant difference in the number of

normal versus LSCS or Instrumental delivery in association with urinary tract infection. This could be because of early detection of UTI and appropriate treatment for the same, lesser number of LSCS that happen in our hospital as compared to Western population.

Most common organism causing UTI was *E. coli* followed by *Klebsiella*. The antimicrobial susceptibility data showed that 40.8% of the *E. coli* were extended spectrum beta lactamase producing *E. coli* and 23.3% of the *Klebsiella* were extended spectrum beta lactamase producing *Klebsiella*. There was no significant difference in outcome of urinary tract infection caused by ESBL producing organism versus non ESBL producing organism

CONCLUSIONS

UTI can ideally be prevented by screening for asymptomatic bacteriuria and early appropriate antibiotic therapy to prevent symptomatic urinary tract infection. Patient with risk factors for urinary tract infection need to be identified early and precautions need to be taken to prevent development of the same. In our study preterm premature rupture of membranes, Preterm delivery and post-partum sepsis were statistically significant. Primigravida, multifetal pregnancy, low maternal education, past history of catheterization, urinary tract infection, and anemia were statistically significant risk factors for the development of urinary tract infection. In conclusion, early detection and treatment for symptomatic urinary tract infection prevents adverse maternal and fetal outcomes and reducing mortality and morbidity. This is a preventable cause of mortality.

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