

# Maternal Urinary Tract Infection as a Risk Factor For Neonatal Urinary Tract Infection

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**Keywords.** urinary tract infections, newborn infant, pregnancy complications

**Introduction.** The aim of the present study was to evaluate the association of maternal UTI during pregnancy with neonatal UTI.

**Materials and Methods.** One hundred and fourteen neonates admitted to hospital were enrolled in the present study, of whom 40 were admitted for management of UTI and 74 for management of jaundice. Urinalysis and urine culture were carried out for all of the neonates. Data regarding gestational age, history of UTI in the mother during pregnancy, and urinary symptoms of neonates were collected.

**Results.** The mean gestational age of the neonates was  $38.4 \pm 1.4$  weeks (range, 30 to 40 weeks) and their mean age at admission was  $6.2 \pm 3.8$  days old (range, 1 to 25 days). The mean gestational age and birth weight of the two groups with and without UTI were  $38.38 \pm 1.32$  weeks versus  $38.41 \pm 1.62$  weeks and  $2930.43 \pm 492.15$  g versus  $2930 \pm 447.33$  g, respectively. No abnormal findings were detected on physical examinations, and none of the neonate had abnormal renal ultrasonography findings. There was a significant relationship between maternal prenatal UTI and neonatal infection; 30.0% of the neonates with UTI versus 6.8% of those without UTI had mothers with a history of UTI (odds ratio, 5.9; 95% confidence interval, 1.9 to 18.3;  $P = .001$ ).

**Conclusions.** Our study showed an association between maternal and neonatal UTI. This indicates a possible benefit of evaluation of neonates of mothers who had UTI during pregnancy.

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## INTRODUCTION

Pregnant women may develop urinary tract infection (UTI) during pregnancy. The infection and its management may have adverse effects on the pregnancy outcome. Maternal UTI is independently associated with preterm delivery, preeclampsia, intrauterine growth retardation, and cesarean delivery.<sup>1</sup> Pregnant women with asymptomatic bacteriuria are also more likely to deliver preterm.<sup>2</sup> In addition, maternal UTI can be associated with some types of malformations.<sup>3,4</sup>

Urinary tract infection poses the risk of mortality

and morbidity in neonates. Various risk factors such as abnormal urinary tract are associated with UTI in newborns. In infants with normal urinary systems, an age less than 6 months and nonretractile prepuces are the most important risk factors for recurrent UTIs.<sup>5</sup> Gender and the presence of a peripheral intravenous catheter are also associated with UTI.<sup>6</sup> Finally, formula-fed infants and vitamin D supplementation showed an increased risk of UTI.<sup>7</sup> However, data regarding the association of maternal UTI with subsequent UTIs in the newborn babies are scarce. The aim of

the present study was to evaluate UTI in pregnant women as a risk factor for neonatal UTI.

## MATERIALS AND METHODS

In a case-control study 40 neonates with a diagnosis of UTI admitted during a 6-month period in 2010 were included in the study based on a convenient sampling method. For comparison, 74 neonates (aged less than 1 month) admitted for management of hyperbilirubinemia during the same time were selected as controls. The inclusion criteria were a diagnosis of UTI without obvious anomaly. Urinary tract infection was defined as growth of more than  $10^5$  colony-forming units per milliliter of one organism. In case of a positive urine culture, another sample was taken for repeat culture before antibiotic administration. In the control group, neonates with signs and symptoms of infection (lethargy, poor feeding, fever, hypothermia, etc) were excluded.

Data were collected, including gestational age, gender, birth weight, and clinical symptoms related to UTI. Gestational age was estimated based on the last menstrual period. The external genital was examined for anomalies associated with UTI, such as labial adhesion. The mothers were asked about the history of UTI during pregnancy and if positive, the trimester in which UTI had occurred. Physical examination for all neonates and renal ultrasonography for neonates with UTI were done. Urinalysis and urine culture were carried out for all the neonates. Urine samples for culture were taken by urine bag.

The correlation between UTI in neonates and maternal UTI and time of infection during pregnancy were tested by the chi-square test. Odds ratios and confidence intervals were also calculated. Comparison of gestational age, birth weight, age of admission was performed between the two groups using the Student *t* test. Data analyses were done using the SPSS software (Statistical Package for the

Social Sciences, version 16.0, SPSS Inc, Chicago, Ill, USA). A *P* value less than .05 was considered significant.

## RESULTS

A total of 114 neonates with a mean gestational age of  $38.4 \pm 1.4$  weeks (range, 30 to 40 weeks) and a mean weight of  $2930.3 \pm 472.0$  g (range, 1700 g to 3700 g) were evaluated. The mean gestational age and birth weight of the two groups with and without UTI were  $38.38 \pm 1.32$  weeks versus  $38.41 \pm 1.62$  weeks and  $2930.43 \pm 492.15$  g versus  $2930 \pm 447.33$  g, respectively (Table).

The mean age of the neonates was  $6.2 \pm 3.8$  days old (range, 1 to 25 days) at the admission time. Of all the neonates, 56.8% were males, and slightly more neonates with UTI were males (65.9%; *P* = .10). No abnormal findings were detected on physical examinations, and none of the neonate had abnormal renal ultrasonography findings in neither of the groups.

In the UTI group, the most common uropathogen was *Escherichia coli* (65.9%), followed by *Klebsiella* (14.6%) and *Staphylococci* (9.8%). Overall, 14.9% had mothers with a positive history of UTI during their pregnancy (4.4%, 6.1%, and 4.4% during the 1st, 2nd, and 3rd trimesters, respectively). There was a significant relationship between maternal prenatal UTI and neonatal infection; 30.0% of the neonates with UTI versus 6.8% of those without UTI had mothers with a history of UTI (odds ratio, 5.9; 95% confidence interval, 1.9 to 18.3; *P* = .001). This trend was especially reflected in the 3rd trimester.

Eleven percent of the neonates were preterm and 21.2% had a low birth weight. There was no difference between the two groups regarding gender, gestational age, or birth weight.

## DISCUSSION

The present study showed that maternal UTI during pregnancy, especially in the 3rd trimester,

Comparison of Basic Data of Neonates With Urinary Tract Infection and Control Neonates

Parameter	Cases	Controls	<i>P</i>
Gestational age, wks	$38.41 \pm 1.63$	$38.39 \pm 1.33$	.93
Birth weight, g	$2930.00 \pm 447.34$	$2930.43 \pm 492.15$	.99
Male gender, %	65.9	51.9	.10
Age at admission, d	$5.07 \pm 2.37$	$6.82 \pm 4.37$	.006
Age at onset of jaundice, d	$3.61 \pm 1.91$	$4.67 \pm 3.13$	.05
Prematurity, %	7.3	13.0	.27

was a risk factor for UTI in neonates. Many risk factors make neonates prone to UTI. Gender, prematurity, urinary tract abnormality, and no circumcision and traditional circumcisions in males are associated with UTI in neonates.<sup>6,8-12</sup> Breastfeeding has the protective role against UTI.<sup>6,13</sup> Urinary tract infection is more prevalent in male neonates.<sup>10,14</sup>

In the present study, *E coli* was the most common uropathogen among our neonates with UTI. Johnson and Clabots showed that *E coli* colonies can be extensively shared among human and animal household members in the absence of sexual contact and in patterns suggesting host-to-host transmission.<sup>15</sup> Based on our findings, we can speculate that within-household sharing of *E coli*, including in households in which a member has a UTI, is common and can involve any combination of humans and pets.<sup>16</sup> Within-household sharing of uropathogen organisms may also be involved in neonatal UTI. A higher prevalence of UTI in neonates of mother with UTI may be the result of such a uropathogen sharing.

## CONCLUSIONS

Based on the result of the present study, UTI during pregnancy increases the risk of UTI in the neonate. Sharing uropathogens may be the underlying mechanism. For identification of the precise mechanism, serotyping and genotyping of organisms causing UTI both in the mothers and their neonates are recommended.

## CONFLICT OF INTEREST

None declared.

## REFERENCE

- Mazor-Dray E, Levy A, Schlaeffer F, Sheiner E. Maternal urinary tract infection: is it independently associated with adverse pregnancy outcome? *J Matern Fetal Neonatal Med.* 2009;22:124-8.
- Sheiner E, Mazor-Drey E, Levy A. Asymptomatic bacteriuria during pregnancy. *J Matern Fetal Neonatal Med.* 2009;22:423-7.
- Cleves MA, Malik S, Yang S, Carter TC, Hobbs CA. Maternal urinary tract infections and selected cardiovascular malformations. *Birth Defects Res A Clin Mol Teratol.* 2008;82:464-73.
- Feldkamp ML, Reefhuis J, Kucic J, et al. Case-control study of self reported genitourinary infections and risk of gastroschisis: findings from the national birth defects prevention study, 1997-2003. *BMJ.* 2008;336:1420-3.
- Shim YH, Lee JW, Lee SJ. The risk factors of recurrent urinary tract infection in infants with normal urinary systems. *Pediatr Nephrol.* 2009;24:309-12.
- Levy I, Comarsca J, Davidovits M, Klinger G, Sirota L, Linder N. Urinary tract infection in preterm infants: the protective role of breastfeeding. *Pediatr Nephrol.* 2009;24:527-31.
- Katikaneni R, Ponnappakkam T, Ponnappakkam A, Gensure R. Breastfeeding does not protect against urinary tract infection in the first 3 months of life, but vitamin D supplementation increases the risk by 76%. *Clin Pediatr (Phila).* 2009;48:750-5.
- Singh-Grewal D, Macdessi J, Craig J. Circumcision for the prevention of urinary tract infection in boys: a systematic review of randomised trials and observational studies. *Arch Dis Child.* 2005;90:853-8.
- Prais D, Shoov-Furman R, Amir J. Is ritual circumcision a risk factor for neonatal urinary tract infections? *Arch Dis Child.* 2009;94:191-4.
- Toker O, Schwartz S, Segal G, Godovitch N, Schlesinger Y, Raveh D. A costly covenant: ritual circumcision and urinary tract infection. *Isr Med Assoc J.* 2010;12:262-5.
- Eliakim A, Dolfin T, Korzets Z, Wolach B, Pomeranz A. Urinary tract infection in premature infants: the role of imaging studies and prophylactic therapy. *J Perinatol.* 1997;17:305-8.
- Bauer S, Eliakim A, Pomeranz A, et al. Urinary tract infection in very low birth weight preterm infants. *Pediatr Infect Dis J.* 2003;22:426-30.
- Marild S, Hansson S, Jodal U, Oden A, Svedberg K. Protective effect of breastfeeding against urinary tract infection. *Acta Paediatr.* 2004;93:164-8.
- Spahiu L, Hasbahta V. Most frequent causes of urinary tract infections in children. *Med Arh.* 2010;64:88-90.
- Johnson JR, Clabots C. Sharing of virulent *Escherichia coli* clones among household members of a woman with acute cystitis. *Clin Infect Dis.* 2006;43:e101-8.
- Johnson JR, Owens K, Gajewski A, Clabots C. *Escherichia coli* colonization patterns among human household members and pets, with attention to acute urinary tract infection. *J Infect Dis.* 2008;197:218-24.

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