

# Evaluation of Maternal Urinary Tract Infection as a Potential Risk Factor for Neonatal Urinary Tract Infection

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Received March 2013; revised and accepted June 2013

## Abstract

**Objective:** To assess the relationship between maternal UTI during pregnancy and neonatal UTI.

**Materials and methods:** This cross-sectional study included eighty neonates referred to Ali-e-Asghar Hospital, Tehran, Iran, in 2011. The participants were divided into the study (with diagnosis of UTI; n=40) and the control (without this type of infection; n=40) groups. The mothers were asked about the history of UTI during pregnancy, and if the response was positive, the trimester in which UTI had occurred. Urinalysis and urine culture were carried out for all neonates.

**Results:** Overall, 14.9% of neonates had mothers with a positive history of UTI during their pregnancy (4.4%, 6.1%, and 4.4% during the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> trimesters, respectively). A significant relationship was detected between the occurrence of UTI in neonates and maternal UTI, so that the overall prevalence of UTI among neonates of affected mothers was significantly higher than that observed among non-infected mothers (30.0% versus 6.8%;  $p = 0.001$ ). Maternal UTI resulted in 5.9-fold increased risk of neonatal UTI. In UTI group, the most common bacterial etiologies of UTI were *Escherichia coli* (65.9%), followed by *Klebsiella* (14.6%) and *Staphylococci* (9.8%).

**Conclusion:** Our findings confirmed the association between the history of UTI in mother and occurrence of UTI in neonate, emphasizing to pay more attention for assessing and managing UTI in neonates in order to reduce the related complications.

**Keywords:** Urinary Tract Infection, Neonate, Mother, Risk, Pregnancy

## Introduction

Urinary tract infection (UTI) during pregnancy, as a common problem, results in maternal and neonatal complications worldwide. The overall prevalence of this event, especially higher in some developing countries, is estimated up to 22 to 35% (1). Various

physiological, anatomical and personal underlying factors predisposing to various types of pathogens have been identified, including urethral dilatation, increased bladder volume and decreased bladder tone with increased urinary stasis (2). UTI during pregnancy is accompanied by adverse health effects for both mother and product of pregnancy (3). In fact, antepartum UTI has been implicated as a risk factor for adverse perinatal outcomes, premature birth and/or low birth weight, and even perinatal death.

UTI in neonates is a common complications with

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a prevalence ranged between 0.1% and 1% in term infants, while between 4% and 25% in very low birth weight infants (4, 5). Although in a number of neonates, it may be usually remained asymptomatic, in most of the cases, the occurrence of UTI can be resulted in severe illnesses states such as growth failure, severe gastrointestinal manifestations, fever, irritability, lethargy, and jaundice (6). In addition, in some cases, a complete sepsis work-up for related cases should be carried out (7).

Neonatal UTI following untreated maternal UTI has been recently suggested as an important life-threatening event after delivery. In a recent study by Emamghorashi et al. (2012) among Iranian neonates, a significant association was found between maternal UTI and neonatal UTI, while it revealed 30.0% of the neonates with UTI versus 6.8% of those without UTI had mothers with a history of UTI (8). The present study aimed to assess the relationship between maternal UTI during pregnancy and neonatal UTI.

## Materials and methods

This cross-sectional study included eighty neonates referred to Ali-e-Asghar Hospital, Tehran, Iran, in 2011. The participants were divided into the study (with diagnosis of UTI; n=40) and the control (without this type of infection; n=40) groups.

None of the neonates had urinary tract abnormalities. Baseline information was collected using both their medical records and an interview with mother as follows: gestational age, gender of neonate, birth weight, and clinical symptoms related to UTI. Gestational age was estimated based on the last menstrual period. The mothers were also asked about the history of UTI during pregnancy and if the response was positive, the trimester in which UTI had occurred. Physical examination, urinalysis and urine culture were performed for all neonates, while renal ultrasonography was carried out only for neonates with UTI. For confirmation of UTI in the study group, sterile sampling by suprapubic aspiration method was used. It was attempted to examine all samples within one hour after sampling. The samples were then stored in a refrigerator at a temperature of 5°C and cultured. Afterward, the samples were transferred to a blood agar. Infantile UTI was defined as growth of colony-forming units per milliliter of at least one pathogenic organism with the clinical symptoms including fever or septicemia.

Results were presented as mean  $\pm$  standard deviation (SD) for quantitative variables, whereas

they were summarized by absolute frequencies and percentages for categorical variables. Categorical variables were compared using chi-square test or Fisher's exact test. The quantitative variables were also compared using the t-test or Mann-Whitney U test. For the statistical analysis, the statistical software SPSS version 19.0 for windows (SPSS Inc., Chicago, USA) was used. The value of  $p \leq 0.05$  was considered statistically significant.

## Results

Totally, 80 neonates were entered into the study, among whom 40 neonates had the mothers with the history of UTI during pregnancy, considered as the study group, and other 40 neonates had the mothers without history of UTI during this period, considered as the control group. The average age of mothers with and without UTI are 26.5 and 26.9 years, respectively, while the mean of body mass index (BMI) of study and control groups are 25.0 and 25.6 kg/m<sup>2</sup>, respectively. Our findings reveals the two groups of mothers were similar in the following terms: gestational age at time of UTI diagnosis, delivery time, mode of delivery, birth weight of neonate, and sex of neonate; moreover, history of UTI was more prevalent in the study group. No abnormal findings were detected on physical examinations, and none of the neonate showed any renal abnormalities in ultrasonography finding. In UTI group, the most common bacterial etiologies of UTI were *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). In this study, a significant relationship was detected between the occurrence of UTI in neonates and maternal UTI, so that the overall prevalence of UTI among neonates of affected mothers was significantly higher than that observed among non-infected mothers (30.0% versus 6.8%;  $p = 0.001$ ). In fact, maternal UTI resulted in 5.9-fold increased risk of neonatal UTI.

## Discussion

The present study pointed out the increased risk of neonatal UTI among those with the mothers suffered from UTI during pregnancy; in addition, the risk of UTI is approximately estimated to be six times more than control group. Similar to our study, in a study by Emamghorashi et al. (2012) on a similar population, they have revealed an association between maternal

**Table 1:** Characteristic of mothers with and without urinary tract infection (UTI)

Characteristics	Mothers with UTI n = 40	Mothers without UTI n = 40	p value
Age, year (SD)	26.5 (4.5)	26.9 (4.3)	0.103
Body mass index, kg/m <sup>2</sup> (SD)	25.0 (.30)	25.6 (3.1)	0.800
Gestational age on diagnosis, week (SD)	11.0 (0.8)	12.0 (0.6)	0.832
Gestational age on delivery, week (SD)	37.9 (7.4)	38.3 (2.1)	0.550
Cesarean section delivery (%)	24 (60.0)	18 (45.0)	0.401
Birth weight of neonate, gram (SD)	3416 (680)	3328 (429)	0.601
Male neonate (%)	24 (60.0)	23 (57.5)	0.580
Familial history of UTI (%)	18 (45.0)	5 (12.5)	0.001

and neonatal UTI (8). According to our ultrasonographic findings, it seems that the important sources of neonatal UTI might be associated with both neonatal and maternal-related causes such as adverse pregnancy outcome or especial conditions during pregnancy. It has been well known that maternal UTI is independently associated with pre-term delivery, preeclampsia, or intra-uterine growth restriction (9) that may predispose neonate to infectious conditions. Also, some neonatal risk factors, including other associated infectious diseases, use of broad-spectrum antibiotics, mechanical ventilation, parenteral nutrition, and intravascular catheters were shown to be associated with increased risk of neonatal UTI (10). In total, higher incidence of neonatal UTI in mothers suffering from UTI may be independently associated with especial conditions of mothers during pregnancy

It should be also noted that the majority of neonates are undiagnosed due to asymptomatic UTI. Failure to recognize the symptoms of neonatal UTI makes it impossible to pursue other diagnostic methods and causes serious complications in neonates. Also, two major causes leading to significant difference in the incidence of UTI between the study and control groups were different definition of neonatal UTI and ignoring other risk factors of this bacterial illness as main confounders. It is recommended to consider maternal UTI along with other potential risk factors for neonatal UTI in a multivariable regression models for confirming the effective role of maternal UTI; however, it was impossible to consider other confounders in our study due to small sample size.

Our findings showed *Escherichia coli* (66%) as the most common bacterial etiologies of neonatal UTI. In the study of Emamghorashi et al. (2012), *Escherichia coli* was the leading organism in 76.3%

of neonatal UTI that was consistent with results of other studies, including Safar et al. (2008) (11) and Zorc et al. (2005) (12) with a relative frequency of 80% and Shaw et al. (1998) (13) with a relative frequency of 89%. The similar finding was also reported by Feld et al. (1989) (14). Although this pathogen has been commonly isolated in these neonates, high resistant to different antimicrobial agents such as ampicillin, cephalosporins, and aminoglycosides have been recently reported, so it has raised concerns regarding the necessity of amendment to the common empirical therapy (15- 17). According to confirmed association between history of UTI in mothers and occurrence of UTI in their neonates, evaluation of antimicrobial resistance to common used antibiotics, particularly in this group of neonates, should be consistently considered.

In conclusion, our study demonstrated an association between the history of UTI in mother and occurrence of UTI in neonate, emphasizing to pay more attention for assessing and managing UTI in neonates in order to reduce related complications.

### Acknowledgments:

This study is supported by Iran University of Medical Sciences. There is no conflict of interest in this study.

### References

1. Delzell JE Jr, Lefevre ML. Urinary tract infections during pregnancy. *Am Fam Physician* 2000; 61:713-21.
2. Brumfitt W. The effects of bacteriuria in pregnancy on maternal and fetal health. *Kidney Int Suppl* 1975; 4: S113-9.
3. McGrady GA, Daling JR, Peterson DR. Maternal urinary tract infection and adverse fetal outcomes. *Am J Epidemiol* 1985; 121:377-81.
4. Sastre JB, Aparicio AR, Cotallo GD, Colomer BF, Hernández MC; Grupo de Hospitales Castrillo. Urinary tract infection in the newborn: clinical and radio

- imaging studies. *Pediatr Nephrol* 2007; 22:1735-41.
5. Eliakim A, Dolfen 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.
  6. Garcia FJ, Nager AL. Jaundice as an early diagnostic sign of urinary tract infection in infancy. *Pediatrics* 2002; 109:846-51.
  7. Khalesi N, Shahraki T, Haghghi M. Prevalence of urinary tract infection in neonates with prolonged jaundice referred to Aliasghar Hospital in Zahedan (2005). *J Qazvin Univ Med Sci* 2007; 11:14-8.
  8. Emamghorashi F, Mahmoodi N, Tagarod Z, Heydari ST. Maternal urinary tract infection as a risk factor for neonatal urinary tract infection. *Iran J Kidney Dis* 2012; 6:178-80.
  9. 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.
  10. Falcão MC, Leone CR, D'Andrea RA, Berardi R, Ono NA, Vaz FA. Urinary tract infection in full-term newborn infants: risk factor analysis. *Rev Hosp Clin Fac Med Sao Paulo* 2000; 55:9-16.
  11. Saffar MJ, Enayti AA, Abdolla IA, Razai MS, Saffar H. Antibacterial susceptibility of uropathogens in 3 hospitals, Sari, Islamic Republic of Iran, 2002-2003. *East Mediterr Health J* 2008; 14:556-63.
  12. Zorc JJ, Levine DA, Platt SL, Dayan PS, Macias CG, Krief W, Et al. Clinical and demographic factors associated with urinary tract infection in young febrile infants. *Pediatrics* 2005; 116:644-8.
  13. Shaw KN, McGowan KL, Gorelick MH, Schwartz JS. Screening for urinary tract infection in infants in the emergency department: which test is best? *Pediatrics* 1998; 101:1-5.
  14. Feld LG, Greenfield SP, Ogra PL. Urinary tract infections in infants and children. *Pediatr Rev* 1989; 11:71-7.
  15. Friedman S, Shah V, Ohlsson A, Matlow AG. Neonatal escherichia coli infections: concerns regarding resistance to current therapy. *Acta Paediatr* 2000; 89:686-9.
  16. Joseph TA, Pyati SP, Jacobs N. Neonatal early-onset Escherichia coli disease. The effect of intrapartum ampicillin. *Arch Pediatr Adolesc Med* 1998; 152:35-40.
  17. Towers CV, Carr MH, Padilla G, Asrat T. Potential consequences of widespread antepartal use of ampicillin. *Am J Obstet Gynecol* 1998; 179:879-83.