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Research Article

Are antepartum urinary tract infections associated with adverse perinatal outcomes in Kenya?

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Background: Pregnant women are considered immuno-compromised because of the physiologic changes associated with pregnancy. Consequently, they often host urinary tract infections which have been implicated as a risk factor for numerous complications.

Objective: To investigate the antepartum urinary tract infection profile among pregnant women in Kenya and their association with perinatal outcomes.

Methodology: A retrospective cohort of expectant women admitted at Kisii Level 5 hospital in 2012 were studied to determine the prevalence of urinary tract infections in pregnancy. The antenatal records were also correlated with adverse perinatal outcomes.

Results: Out of the 2014 pregnant women attending clinic in this study, 14.4% were diagnosed with urinary tract infections in the third trimester. The prevalence rate of the infections was affected by the age, with pregnant women below 25 years showing higher susceptibility (P= 0.018) compared to pregnant women above 35 years age group. There was a significant association between preterm delivery, low birth weights and urinary tract infections in pregnant women (P<0.01). However, there was no significant correlation between maternal urinary tract infections and the incidence of neonatal sepsis at P=0.05.

Discussion: Pregnant women under the age of 25 are vulnerable to urinary tract infections resulting in adverse perinatal outcomes in the study population. This reinforces the need for screening of pregnant women and treatment of urinary tract infections to reduce perinatal complications. Further research is required to elucidate the underlying risk factors for neonatal sepsis.

Key Words: pregnancy, urinary tract infections, perinatal outcomes, preterm delivery, low birth weight

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1. Introduction

Urinary tract infections (UTI) are one of the most common bacterial infections that affect mankind, and occurs 14 times more frequently in women than in men (Theodor, 2007). The risk of UTI increases further during pregnancy, with prevalence of asymptomatic bacteriuria (ASB) in pregnant women being between 2.5-11% as opposed to 3-8% in non-pregnant women (Mittal and Wing, 2005; Obirikorang et al, 2012). This is attributed to increase in urinary progesterones and estrogens as well as decreased ureteral tone that may predispose the lower urinary tract to invading bacteria (Johnson, 2011). Approximately, 70% of pregnant women develop glycosuria and aminoaciduria, thus providing an excellent culture medium for a wide spectrum of bacteria causing urine stasis ((Delzell et al, 2000). In addition, lowered immune responses that occur during pregnancy also contribute to increased incidence of UTI in pregnancy (Onuh et al, 2006).

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The association between antepartum urinary tract infections and adverse perinatal outcomes has remained a matter of conjecture. Evidence issued from microbiological analysis of the genito-urinary tract of women with premature labour or preterm rupture of membranes, show that UTI is the most important risk factor for perinatal morbidity and foetal death (Sheiner et al, 2009; Mazor-Dray et al, 2009). Similar findings had been reported in a large cohort study conducted in the USA where UTIs were also associated with the risk of small-for-gestational-age newborns (Schieve et al, 1994). Routine screening and treatment of pregnant women for UTI in the developed countries has been associated with a decrease in the percentage of preterm infants (Gilbert et al, 2013). On the other hand, other authors have reported inconsistent results that failed to prove such associations. In Taiwan for instance, Chen et al, (2010) observed that women exposed to antepartum pyelonephritis or non-pyelonephritic UTIs were not at increased risk of having low-birth-weight infants (LBW), preterm birth and small-for-gestational age babies (SGA), compared to mothers who were not exposed to UTIs.

These conflicting results highlight the need for more data on UTI and its impact on pregnancy outcome. While prevalence of UTI during pregnancy has been extensively documented from several African countries (Masinde et al, 2009; Hamdan et al, 2011; Wamalwa et al, 2013), there is no published data on its association with adverse perinatal outcomes in Kenya. This study was therefore conducted to determine if antepartum urinary tract infections were accompanied with preterm deliveries, LBW and neonatal sepsis in a population in Kisii region in Kenya.

2. Methodology

2.1 Study site

This study was conducted at Kisii level 5 hospital, located in Kisii County, Western Kenya. This is a regional referral hospital covering South Nyanza, South Rift and the entire Gusii region with a catchment of 3 million people.

2.2 Study design

A retrospective cohort analysis of expectant women admitted at Kisii level 5 hospital antenatal clinic was performed to determine the prevalence of urinary tract infections in pregnancy using registry data. The antenatal records were also correlated with adverse perinatal outcomes.

2.3 Study population and eligibility criteria

A total of 2014 pregnant women attending antenatal clinic from January to June 2012 were analysed. Data collection involved review of medical records on the database and files from the Maternal and Child Health clinic in the hospital. Information obtained from the case notes include age of the mother, presenting symptoms and perinatal records.

The inclusion criteria was all pregnant women attending the antenatal clinic and delivered within the hospital. The only mothers who were excluded from the study sample were those who never delivered within the respective hospital facility.

2.4 Sampling procedure

Classification of urinary tract infection was based on a positive urine culture during the antepartum period, as noted by a health care provider and recorded in the medical record, or a diagnosis of urinary tract infection and/or pyelonephritis during the antepartum period recorded in the medical record.

This allowed inclusion of cases of urinary tract infection diagnosed by a variety of methods. In most cases, it was not possible to discern the way in which a diagnosis was made from the information provided in the record. Our definition of urinary tract infection encompassed both asymptomatic and symptomatic infections

The perinatal outcomes examined in this study included preterm delivery (less than 37 weeks gestation), low birth weight (2500g or lower) and neonatal sepsis.

2.5 Statistical analysis

The data were analyzed with SPSS version 20.0 (SPSS, Chicago, IL, USA). Pearson correlation coefficient was used to measure the strength of association between variables. Single factor analysis of variance was also used to determine if there is significant differences between mean numbers of cases among different age groups. All statistical tests were two-sided and considered statistically significant when $P < 0.05$.

2.6 Ethical considerations

Clearance to conduct the study was obtained from the Department of Biochemistry and the Kenyatta National Hospital/ University of Nairobi Ethics and Research Committee (KNH/UON-ERC), Ref No: **KNH-ERC/A/348**. Confidentiality on patient identity and clinical record was observed during data collection process.

3. Results

Registry records of expectant women admitted at Kisii Level 5 hospital in 2012 was analyzed to determine the prevalence of urinary tract infections in pregnancy. Demographic data showed that out of a total of 2014 obstetric patients who visited the antenatal clinic, 40.7% were below 25years, 41.3% were between 25-35 years, while 18% were above 35 years age group (**Figure 1**). The prevalence of UTI amongst the study group stratified by age group is also shown in **Figure 1**. Out of 2014 pregnant women sampled, 290 (14.4%) had UTI in the third trimester, with the highest prevalence of 41% observed in women below 25 years of age. This was followed by women within 25-35years (35%), while women above 35years age group were least vulnerable (23%). A strong correlation existed between pregnancy and the occurrence of UTI at $P<0.01$ (**Table 1**).

Apart from maternal infection, other variables on perinatal outcomes examined in this study included preterm delivery (less than 37 weeks gestation), low birth weight (2500g or lower) and neonatal sepsis. Preterm delivery and low birth weights (LBW) occurred in 15.1% and 15.4% of pregnant women with UTIs,

respectively. The increased risk of preterm delivery and LBW among pregnant women exposed to UTI was highly significant (P<0.01) (**Table 1**). However, the incidence of neonatal sepsis among pregnant women with UTI was 8.4%, which was not significant at P<0.05.

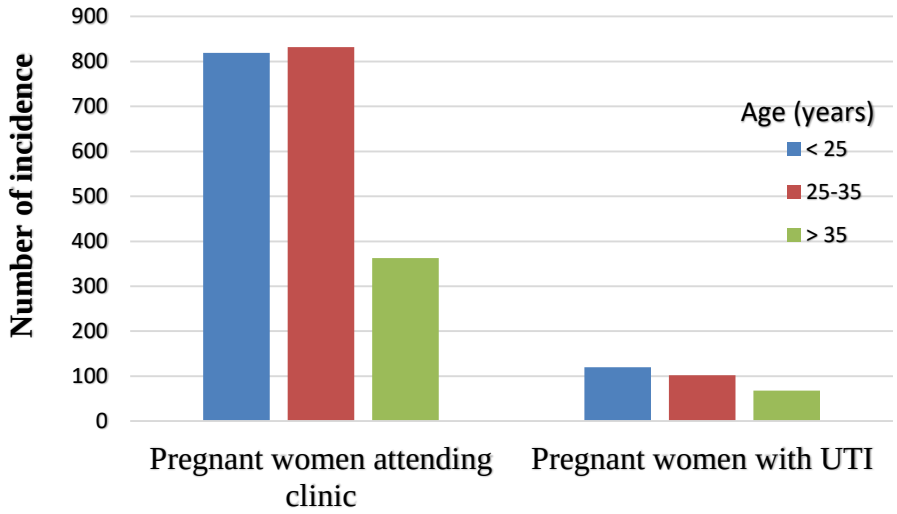

Figure. 1: Rates of urinary tract infection in pregnant women of different age groups (n=2014)

Table 1: Correlation between Maternal age, urinary tract infections and pregnancy outcomes

		Pregnant women with UTI (n=290)	Preterm deliveries	Low birth weights	Neonatal sepsis	Age (years)	Pregnant women attending clinic (n=2014)
Pregnant women with UTI	Pearson Correlation	1	.764**	.826**	.462	-.623**	.838**
	Sig. (2-tailed)		.000	.000	.054	.006	.000
	N	18	18	18	18	18	18
Preterm deliveries	Pearson Correlation	.764**	1	.910**	.466	-.686**	.762**
	Sig. (2-tailed)	.000		.000	.051	.002	.000
	N	18	18	18	18	18	18
Low birth weights	Pearson Correlation	.826**	.910**	1	.563*	-.661**	.839**
	Sig. (2-tailed)	.000	.000		.015	.003	.000
	N	18	18	18	18	18	18
Neonatal sepsis	Pearson Correlation	.462	.466	.563*	1	-.676**	.347
	Sig. (2-tailed)	.054	.051	.015		.002	.159
	N	18	18	18	18	18	18
Age (years)	Pearson Correlation	-.623**	-.686**	-.661**	-.676**	1	-.716**
	Sig. (2-tailed)	.006	.002	.003	.002		.001
	N	18	18	18	18	18	18
Pregnant women attending clinic	Pearson Correlation	.838**	.762**	.839**	.347	-.716**	1
	Sig. (2-tailed)	.000	.000	.000	.159	.001	
	N	18	18	18	18	18	18

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

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Table 2: Relationship between exposure to antepartum urinary tract infection and selected perinatal outcomes

		Sum of Squares	df	Mean Square	F	Sig.
Pregnant women with UTI	Between Groups	232.444	2	116.222	5.019	.021
	Within Groups	347.333	15	23.156		
	Total	579.778	17			
Preterm deliveries	Between Groups	604.000	2	302.000	7.029	.007
	Within Groups	644.500	15	42.967		
	Total	1248.500	17			
Low birth weights	Between Groups	411.444	2	205.722	6.201	.011
	Within Groups	497.667	15	33.178		
	Total	909.111	17			
Neonatal sepsis	Between Groups	536.778	2	268.389	11.319	.001
	Within Groups	355.667	15	23.711		
	Total	892.444	17			

Table 2 shows that there were significant differences between mean numbers of cases of UTI in each variable across different age groups. A comparison of occurrences of UTI among the different age groups showed pregnant women below 25 years had significantly high likelihood of testing positive for UTI (P= 0.018) compared to pregnant women above 35 years age group (**Table 3**). The frequency of occurrence of preterm delivery among pregnant women below 25 years was significantly higher at P=0.006 compared to pregnant women above 35 years. Similarly, low birth weight outcome was significantly higher among pregnant women below 25 years (P=0.009) compared to pregnant women above 35 years age group (**Table 3**).

Table 3: Association of antepartum urinary tract infection and selected perinatal outcomes based on maternal age

Dependent Variable	(I) AGE (Years)	(J) AGE (Years)	Mean Difference (I-J)	Std. Error	Sig. (P value)	95% CI	
						Lower Bound	Upper Bound
Pregnant women with UTI	<25	25-35	3.000	2.778	.540	-4.22	10.22
		>35	8.667*	2.778	.018	1.45	15.88
	25-35	<25	-3.000	2.778	.540	-10.22	4.22
		>35	5.667	2.778	.137	-1.55	12.88
	>35	<25	-8.667*	2.778	.018	-15.88	-1.45
		25-35	-5.667	2.778	.137	-12.88	1.55
Preterm deliveries	<25	25-35	5.000	3.784	.406	-4.83	14.83
		>35	14.000*	3.784	.006	4.17	23.83
	25-35	<25	-5.000	3.784	.406	-14.83	4.83
		>35	9.000	3.784	.075	-.83	18.83
	>35	<25	-14.000*	3.784	.006	-23.83	-4.17
		25-35	-9.000	3.784	.075	-18.83	.83
Low birth weights	<25	25-35	3.833	3.326	.498	-4.80	12.47
		>35	11.500*	3.326	.009	2.86	20.14
	25-35	<25	-3.833	3.326	.498	-12.47	4.80
		>35	7.667	3.326	.086	-.97	16.30
	>35	<25	-11.500*	3.326	.009	-20.14	-2.86
		25-35	-7.667	3.326	.086	-16.30	.97
Neonatal sepsis	<25	25-35	11.500*	2.811	.003	4.20	18.80
		>35	11.667*	2.811	.002	4.36	18.97
	25-35	<25	-11.500*	2.811	.003	-18.80	-4.20
		>35	.167	2.811	.998	-7.14	7.47
	>35	<25	-11.667*	2.811	.002	-18.97	-4.36
		25-35	-.167	2.811	.998	-7.47	7.14

*. The mean difference is significant at the 0.05 level.

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4. Discussion

The overall prevalence of UTI among pregnant women in this study was 14.4%. This is similar to prevalence rates of UTI in pregnant women reported in Central Kenya (14.2%) and other neighbouring countries in Africa (Wamalwa et al, 2013; Hamdan et al, 2011; Masinde et al, 2009; Assefa et al, 2008). However, the prevalence of UTI observed in our study is significantly high compared to those reported in developed countries and this is likely to be attributed to environmental and low socio-economic status (Gilstrap et al, 2001; Santos et al, 2002). Socio-demographic characteristics like age, parity, gestation age and level of education have been implicated in UTI among pregnant women (Dimetry et al, 2007; Haider et al, 2010). Likewise in this study, maternal age was found to be a risk factor for UTI, with pregnant women below 25 years being more vulnerable compared to those above 35 years age group.

One of the main findings of this study was the significantly higher risk of preterm deliveries (15.1%) and low birth weights (15.4%) among pregnant women exposed to UTI. This high incidence was significantly common among pregnant women maternal under the age of 25 years ($P < 0.01$). The association between perinatal outcomes and UTIs has been studied in the developed countries for many years (Mittal and Wing 2005; Duarte et al, 2008; Mazor-Dray et al, 2009; Gravett et al, 2010). From a global health perspective, UTI was reported to be one of the most important and potentially preventable causes of early preterm birth (Simmons et al, 2010). Indeed the results of this study clearly revealed that exposure to UTI during pregnancy was one of the main factors that contributed to the occurrence of premature labor and low birth weight. However, antepartum UTI played no significant role in the incidence of neonatal sepsis.

The increased incidence of preterm labor and delivery associated with UTIs can be explained by the inflammatory response induced by cytokines and prostaglandins released by the microorganisms (Randis et al, 2014). Another way in which preterm labor can be triggered is through the colonization of amniotic fluid by uropathogens originated from UTIs. These bacteria produce phospholipases A and C, that act as precursors of pro-contractile prostaglandins E2 and F2a, consequently triggering preterm labor (Duarte et al, 2008; Bhutta et al, 2010).

5. Conclusion

Urinary tract infection is still one of the commonest problems during pregnancy and has a significant impact on perinatal outcome, mainly premature labor and low birth weight. It is therefore important that all expectant mothers are screened for UTI and treated if positive to reduce these risks. Further research is also required to elucidate the underlying risk factors for neonatal sepsis.

Conflict of Interest

The authors declare no conflict of interest.

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