The Open Access Journal of Science and Technology
Vol. 3 (2015), Article ID 101115, 6 pages
doi:10.11131/2015/101115

AgiAl Publishing House
http://www.agialpress.com/

Research Article

Prevalence of Urinary Tract Infection, Microbial Aetiology, and Antibiotic Sensitivity Pattern among Antenatal Women Presenting with Lower Abdominal Pains at Kenyatta National Hospital, Nairobi, Kenya

Willy Fred Nabbugodi, J. Wanyoike Gichuhi, and N. W. Mugo

Department of Obstetrics and Gynaecology, University of Nairobi, P.O. Box 19676, Nairobi, Kenya

Corresponding Author: J. Wanyoike Gichuhi; email: drjoewanyoike@yahoo.co.uk

Received 29 October 2014; Accepted 4 December 2014

Academic Editor: Shalev Eliezer

Abstract. *Objective*. To determine the prevalence of urinary tract infection as a cause of lower abdominal pains among antenatal women and its aetiological microorganism and define the sensitivity pattern to commonly used antibiotics. *Study Design*. A cross sectional study. *Setting*. Kenyatta National Hospital, Nairobi, Kenya. *Subjects*. One hundred and fifty antenatal women. *Main Outcome Measures*. Overall the prevalence of urinary tract infection, its aetiological causes, and antibiotic sensitivity pattern. *Results*. The prevalence of UTI among antenatal women presenting with lower abdominal pains in Kenyatta National Hospital was found to be 26.7%. Of the 40 women with positive culture urine, 31 (C77.8%) were also positive on dipstick and 27 (67.5%) were positive on urine microscopy. There is significant correlation between urine dipstick testing, urine microscopy, and positive urine culture in UTI. Dipstick test and urine microscopy test had high sensitivity and specificity in screening for UTI. The predominant bacterial pathogens were *Escherichia coli* at 40% followed by *Staphylococcus* spp. at 25% and *Klebsiella* spp. at 10%. There were also *Enterococcus*, *Enterobacter,* and *Citrobacter* species. The isolated gram-negative bacteria were 100% sensitive to meropenem, imipenem, augmentin, ceftazidime, and levofloxacin and about 81% to cefuroxime. The bacteria showed significant resistance to gentamycin and ampicillin of up to 80%. The isolated gram-positive bacteria were 100% sensitive to augmentin, cefuroxime, ceftriaxone, ceftazidime, meropenem, and imipenem but showed significant resistance to levofloxacin, gentamycin, nitrofurantoin, and ampicillin of between 20% and 80%.

Keywords: Antenatal women; urinary tract infection; bacterial pathogens; antibiotic sensitivity

1. Introduction

Urinary tract infection is the commonest bacterial infection in pregnancy. It occurs more frequently in developing countries among the low socioeconomic populations. In the USA surveys, it is estimated that there are about 8 million cases of UTI annually with huge economic implications [3]. Foxman B. [6] found prevalence rate of UTI in pregnant women in America to be 2.5–8.7% whereas Valiquez et al. [20] estimated the prevalence of UTI in pregnant women to be 12–40% in developing countries. This was due to the differences in the socioeconomic levels and standards of living [15]. UTI was said to be about 4–10 times more common in pregnant than in the nonpregnant women [17]. This was because, during pregnancy, there is a change in urine chemical composition with increase in glucose and amino acids, which facilitate bacterial growth in urine [11]. Its high frequency is also due to physiological, anatomical, and functional changes that occur in the urinary tract during pregnancy.

Predisposing factors to Asymptomatic bacteriuria (ASB) are low socioeconomic status, increasing age, multiparity, sexual behaviour, urinary tract anomalies, previous treatment for UTI, other medical conditions like diabetes, sickle cell disease, and immune compromised states like AIDS and spinal cord injuries [11, 12].

Patients with asymptomatic urinary tract bacteriuria, 25%, will develop symptomatic urinary tract infection (cystitis, pyelonephritis) than those without [7, 10, 13].

Asymptomatic bacteriuria has been associated with preterm labour and low birth weight infants, intrauterine growth restriction and fatal death, hypertension, preeclampsia, maternal sepsis, respiratory insufficiency, and anaemia [10, 12, 16, 17]. It is thus of significance to screen all pregnant mothers for urinary tract bacteriuria on the first antenatal visit.

Bacteriuria may persist after delivery and may result into overt symptomatic infections and chronic infections.

UTI is more prevalent in young primigravida, in the second trimester, diabetic mellitus, sickle cell disease, human immunity suppression as in human immunosuppression virus, chronic drug abusers, and low social-economic status with poor genital and perennial hygiene [5, 13].

Acute bacterial cystitis presents 1–4% of all pregnancies [6]. Acute pyelonephritis occurs in 1–2% of pregnancies and is the most severe form of UTI and most common indication for ante partum hospitalization [1, 6, 18]. Diagnosis for both is mainly clinical, but also by positive urine culture of at least 100.000cfus/ml of a single uropathogen.

Urinary tract infection is mainly caused by gram-negative organisms that include *E. coli* 60-70%, *Klebsiella* 10%, *Proteus* 5–10%, and *Pseudomonas* 2–5% and gram-positive bacteria, group B *Streptococcus* and *Staphylococcus* species [1]. The gram-positive pathogens are *Streptococcus* species and *Staphylococcus* species [2, 13].

These organisms are mainly from the external genitalia, vagina, the genital tract, rectum, and gastro-intestinal tract. Treatment of UTI varies with the type but is usually empirical because of the common spectrum of uropathogens.

With the mother and the fetus at so much risk due to urinary tract infection in pregnancy, it is important that both asymptomatic bacteriuria and symptomatic UTI be identified and treated appropriately.

2. Materials and Methods

This was a cross sectional study among 150 pregnant women attending clinics/wards at Kenyatta National Hospital which is the national referral hospital in Kenya. This study was carried out in the antenatal clinics, antenatal wards, and maternity wards. The sample size was 150 and the calculation was done using EPI info version 5.

The study utilized purposive sampling technique. Eligible participants were approached and requested to give a voluntary consent to participate in the study. Upon consenting, a study number with a code was assigned for identification. The inclusion criteria were pregnant women presenting with lower abdominal pains without specific cause and no prior antibiotic treatment. Inclusion into the study was done consecutively until the required sample size of 150 women was achieved. The study involved collection of data from the subjects in form of interviews and questionnaires. Data regarding demographic and reproductive characteristics was collected.

Clean catch urine specimens were collected from each of the 150 study participants. All subjects recruited into the study were asked to provide a specimen of clean catch midstream urine that was subjected to a dipstick test; urine microscopy, culture and sensitivity tests, and results were entered into the database.

The clean catch midstream urine specimens from all the subjects were cultured to determine the microorganisms involved and subjected to a sensitivity test to determine the antibiotic sensitivity pattern. Samples were collected with clear instructions to the participants to collect midstream urine after vulva swabbing with clean water.

The specimens were put in a cool box and delivered to the laboratory within one hour of collection. Processing of the specimen was done under set standards for best results.

This too was documented and entered into database. The urine was tested with urine dipsticks, microscopy and cultured for bacterial growth and subjected to drug sensitivity tests. Kenyatta National Hospital microbiology laboratory was used to run the dipstick tests, urine microscopy tests, and the culture and sensitivity test.

The urine was cultured on cysteine lactose electrolyte deficient (CLED) and blood agar media. In this study any organism isolated with colony counts of greater than 100000/ml of urine was considered significant and indicative of a UTI. Bacterial identification was done using the time-honoured methods of Cowen and Steele. Antibiotic sensitivity patterns were studied using the AKH 3/5 discs. All data collected in the study was sorted, coded, and entered in a computer using SPSS program. Data was cross-checked against the data files for any inconsistencies and obvious data

Table 1: Sociodemographic characteristic of antenatal women presenting with lower abdominal pains.

Characteristics	Population	Frequency %
All women	$N = 150$	
Age in years 15–24 25–34 35–44	23 99 28	15.3% 66.0% 18.7%
Marital status Married/cohabiting Single	132 18	88.0% 12.0%
Socioeconomic status Employed Unemployed	94 56	62.7% 37.3%
Previous UTI Yes No	44 106	29.3% 70.7%
Education level Standard 8&< Above standard 8	42 108	28.0% 72.0%

Table 2: Obstetric characteristics of antenatal women presenting with lower abdominal pains.

Characteristics	Population	Frequency %
All women	$N = 150$	
Parity 0 1 2 3 4& above	59 44 26 9 12	39.3% 29.3% 17.3% 6.0% 8.1%
Gestational age in weeks 20-24 25-29 30-34 35-39 40-44	2 2 9 81 56	1.3% 1.3% 6.0% 54.0% 37.4%
Previous obst/gyne surgery Positive Negative	29 121	19.3% 80.7%
Other urinary symptoms(Apart from LAPs) Present Absent	24 126	16% 84%

entry errors. The data entry and editing were done throughout the study.

2.1. Ethical consideration. There was no risk to the participants as there were no invasive procedures done; no drugs were given before the test results. Participants whose test results showed any growth of microbes benefitted by being treated as per the culture and sensitivity results. No adverse reactions to the drugs were expected as these were the drugs routinely used in the department. Failure to participate in the study did not affect services rendered to the patient from the hospital in any way.

3. Result

A total of 150 antenatal women with lower abdominal pains were screened for UTI. The ages of the study population ranged between 19 and 42 years with a mean age 28.8 yrs and standard deviation of ±4.5 yrs. The parity ranged between 0 and 6 with mean parity of 1.48 and standard deviation of ±1.25 (Table 1).

Of the 150 women enrolled in the study 59 (39.3%) were prime gravida, 44 (29.3%) had a parity of one, 26 (17.3%) had parity of 2, 9 women (6.0%) were Para 3 and 8 (5.8%), and 4 (2.8%) were Para 4. About 25 women (16.7%) had at least one abortion in their obstetric career. Of the 150 women 29 (19.35%) had previous obstetric or gynaecological surgery. Only 4 (2.6%) of the women were in the second trimester of their pregnancies. The rest were in the third trimester near term. Twenty-four women (16%) had other UTI symptoms in addition to the lower abdominal pains (Table 2).

The bivariate analysis showed that there was no relationship between the various studied factors since all $P > 0.05$. There was, thus, no relation between maternal age, marital status, parity, prior UTI episodes, or obstetric surgeries (Table 3).

Of the 40 women whose urine was positive for growth of bacteria, 31 (77.5%) also were positive on dipstick testing of the urine and 27 (67.5%) were positive on urine microscopy. Thus the dipstick and urine microscopy tests are simple and highly sensitive highly specific tests that can be used to screen for UTI (Table 4(a)).

3.1. Microbiological profile. Of all the bacteria cultured ($n = 40$) (26.7%), the gram-negative bacteria *E. coli*, *Klebsiella* spp., *Proteus* spp., *Enterobacter*, and *Citrobacter* spp. were the most prevalent at 30 (75%) than the gram-positive *Staph.* spp. 10 (25%). Most commonly isolated bacteria were *E. coli* 12 (40%) followed by *Staphylococcus* spp. at 25%, followed by *Klebsiella* spp. 5 (12.5%), *Enterococcus* spp., and *Proteus* spp., at 4 (10%) each. *Citrobacter* spp. was also isolated in 2.5% of the cultures (Table 4(b)).

3.2. Drug sensitivity patterns. All the gram-negative isolates showed high sensitivity to augmentin, ceftriaxone, ceftazidime levofloxacin, nitrofurantoin, meropenem, and imipenem with variable sensitivity to gentamycin and ampicillin. The gram-positive isolates showed high sensitivity to similar antibiotics except levofloxacin, ampicillin, nitrofurantoin, and gentamycin, which demonstrated significant resistance. *E. coli* was sensitive to all the antibiotics except ampicillin, gentamycin, and cefuroxime; *Citrobacter* spp. was also 100% resistant to ceftazidime (Table 4(c)).

4. Discussion

The overall prevalence of urinary tract infection among pregnant women with lower abdominal pains in KNH in this study was 26.7%. This is comparable to studies done

Table 3: Factors associated with positive bacterial culture in antenatal women.

Characteristic	Women with bacterial culture positive UTI $N = 40$	Women with bacterial culture negative UTI $N = 110$	P-value
Age groups 15-24 25-34 35-44	11(27.5%) 25(62.5%) 4 (10.0%)	12(10.9%) 74(67.3%) 24(21.8%)	0.75
Marital status Single Married	7 (17.5%) 33(82.5%)	11(10.0%) 99(90.0%)	0.26
Parity Primigravida Multigravida	14 (35.0%) 26(65.0%)	45(40.9%) 56(59.1%)	0.41
Previous UTI Yes No	5(12.5%) 35(87.5%)	39(35.5%) 71(64.5%)	0.25
Previous obst surgery Present Absent	7 (17.5%) 33(82.5%)	12 (10.9%) 99 (89.1%)	0.14
Presence of other signs Present Absent	4 (10.0%) 36(90.0%)	20(18.2%) 90(81.8%)	0.19

Table 4

(a) Relationship between dipstick positive urine, microscopy positive, and culture positive in antenatal women.

	Among culture positives ($N = 40$)	Among culture negatives ($N = 110$)
Dipstick positive	31 (77.5%)	18 (16.3%)
Urine microscopy Positive	27(67.5%)	13(11.8%)

(b) Sensitivity, specificity, and predictive values of urine dipstick tests in diagnosis.

Dipstick test	UTI positive culture	Negative culture	Total
Positive	31	18	49
Negative	9	92	101
Total	40	110	150

Sensitivity = **31**/**3**1+9 × 100 = 77.5%

Specificity = 92/92 + 18 × 100 = 83.6%

Positive predictive value = 31/31 + 18 × 100 = 63.3%

Negative predictive value = 92/92 + 9 × 100 = 91.1%

(c) Sensitivity specificity and predictive values of urine microscopy test in diagnosing UTI in antenatal women.

Urine microscopy	UTI positive Urine culture	No UTI negative urine culture	Totals
Positive	27	13	40
Negative	13	97	110
Total	40	110	150

Sensitivity = 27/27 + 13 × 100 = 67.5%

Specificity = 97/97 + 13 × 100 = 88.2%

Positive predictive value = 27/27 + 13 × 100 = 67.5%

Negative predictive value = 97/97 + 13 × 100 = 88.2%

elsewhere in the world. The prevalence of UTI reported in Addis Ababa, Ethiopia, was 11.6% [8] and in a study in Northern Tanzania 16.4% [9], Mwanza, North-Western Tanzania (14.6%) [10], and Khartoum North Hospital, Sudan (14.0%) [11].

This variation may be explained by the differences in the environment, social habits of the community, the standard of personal hygiene, and education. Also the fact that this study was conducted among women who had lower abdominal pains, which is a symptom of UTI, as opposed to the general ANC women studied in the other studies, explaining the slightly higher prevalence of 26.7% in our study. There was no association between maternal age, parity, gravidity, occupation, marital status, and education with UTI in this study. This was in agreement with studies in Tanzania [10] and Sudan [11].

There was no difference in prevalence of urinary tract infection in pregnant women with previous history of urinary tract infection compared to those without. This was in contrast to studies in Pakistan which had shown that previous episode of UTI was a risk factor urinary tract infection in pregnancy. This might have been due to effective treatment for the earlier UTI episodes without any resistance strains.

Gram-negative bacteria isolates were more prevalent (75%) than gram-positive bacteria isolates (25%). Similar rate of isolation of gram-negative and gram-positive bacteria, 60% and 40%, respectively, was reported in Tikur Anbessa Specialized Hospital Addis Ababa, Ethiopia [8], and 61.9% and 38.1% in Tanzania [16] (Table 5). This could be due to the presence of unique structure in gram-negative bacteria which facilitate their attachment to the uroepithelial cells,

Table 5: Bacterial species isolated in antenatal women with lower abdominal pain.

Bacterial species	Number of isolates $N = 40$ (total number of bacterial culture positives)	% of the total
E. coli	16	40.0%
Klebsiella spp.	5	12.5%
Enterobacter spp.	4	10.0%
Proteus spp.	4	10.0%
Citrobacter spp.	1	2.5%
Staph. spp.	10	25.0%

Table 6: Drug sensitivity in antenatal women with UTI.

	E. coli	*Staph*. spp.	*Klebsiella* spp.	*Proteus* spp.	*Enterobacter* spp.	*Citrobacter* spp.
Augmentin	100%	100%	100%	100%	100%	100%
Cefuroxime	80%	100%	100%	50%	100%	100%
Gentamycin	72%	60%	50%	100%	0%	20%
Nitrofurantoin	100%	50%	100%	100%	100%	100%
Ampicillin	50%	20%	50%	70%	70%	80%
Ceftazidime	100%	100%	100%	100%	100%	0%
Levofloxacin	100%	75%	100%	100%	100%	100%
Ceftriaxone	100%	100%	100%	100%	100%	100%
Meropenem	100%	100%	100%	100%	100%	100%
Imipenem	100%	100%	100%	100%	100%	100%

multiplication, and tissue invasion, resulting in invasive infection and pyelonephritis in pregnancy [5].

E. coli was the most predominant pathogen with overall isolation rate of 40.0%. Comparable findings have been reported in Yemen, 41.5%, Nigeria, 42.1%, Khartoum North Hospital, Sudan, 42.4% [20], and Tikur Anbessa Specialized Hospital Addis Ababa, Ethiopia, 44%. *E. coli* is the most common microorganism in the vaginal and rectal area [19]. Anatomical and functional changes and difficulty of maintaining personal hygiene during pregnancy may increase the risk of acquiring UTI from *E. coli.* Gram-positive staphylococci were the second dominant pathogen with overall isolation rate of 25%; comparable findings were also reported from Tikur Anbessa Specialized Hospital Addis Ababa, Ethiopia, 16% [8] and Tanzania, 16.7% [14].

There was high correlation between positive testing on dipstick and urine microscopy and culture positive specimens. Of the 40 women with culture positive urine, 31 (77.5%) were also positive on dipstick, and 27 women (67.5%) were positive on urine microscopy.

In this study and as shown in (Table 6), susceptibility pattern of gram-negative bacteria showed that most of the isolates were sensitive to amoxicillin-clavulanic acid (100%), ceftriaxone (100%), meropenem (100%), gentamicin (72%), imipenem (100%), levofloxacin (100%), ampicillin (50%), nitrofurantoin (100%), ceftazidime (100%), and cefuroxime (81%) . The gram-positive isolates showed a slightly different sensitivity pattern with 100% sensitivity to amoxicillin-clavulanic acid, cefuroxime, imipenem, meropenem, ceftazidime, and ceftriaxone. There was significant resistance to gentamycin, levofloxacin, nitrofurantoin, and ampicillin. The ease availability and indiscriminate use of commonly used drugs such as ampicillin and gentamycin may lead to an increase to resistance. This is not in line with the report in Tikur Anbessa Specialized Hospital Addis Ababa.

In this study the effectiveness of amoxicillin-clavulanic acid to both gram-positive bacteria and gram-negative bacteria is 100%. Therefore amoxicillin-clavulanic acid may be used for empiric therapy. Some of the uropathogens isolated demonstrated significant resistance to more than 2 of the commonly used antibiotics. *Staph*. spp. was resistant to ampicillin, nitrofurantoin, and gentamycin. *Citrobacter* was resistant to ceftazidime and gentamycin. This was also reported in Tikur Anbessa Specialized Hospital Addis Ababa, Ethiopia [8]. This can be explained by antibiotic overuse and abuse [20]. Other reasons for this phenomenon might be inappropriate and incorrect administration of antimicrobial agents in empiric therapies.

In conclusion, given a prevalence of UTI of 26.7%, which is low and does not justify empirical treatment of pregnant women with lower abdominal pains for urinary tract infection, it is recommended that a whole clinical picture is put into perspective and laboratory evaluation of urine is done before women are treated for UTI. There is a good significant correlation between urine dipstick testing, urine microscopy, and positive urine culture in UTI. Dipstick test and urine microscopy test had high sensitivity and specificity in screening for UTI. However, where it is not feasible to do any laboratory work-up of the patient as it happens in developing country, it is recommended that amoxicillin-clavulanic be used as a drug of first choice in suspected UTI on the basis of demonstrated high sensitivity.

Contributions

This study was designed and implemented by Fred Nabogodi, Wanyoike Gichuhi, and Nelly Mugo. F. Nabbogodi was responsible for data collection and data entry. F. Nabogodi and Wanyoike Gichuhi were involved in data analysis and preparation of initial draft of the manuscript.

References

[1] A. Alemu, F. Moges, Y. Shiferaw, K. Tafess, A. Kassu, B. Anagaw, and A. Agegn, Bacterial profile and drug susceptibility pattern of urinary tract infection in pregnant women at University of Gondar Teaching Hospital, Northwest Ethiopia, *BMC Research Notes*, **5, article no. 197**, (2012).

[2] A. Assefa, D. Asrat, Y. Woldeamanuel, Y. G Hiwot, A. Abdella, and T. Melesse, Bacterial profile and drug susceptibility pattern of urinary tract infection in pregnant women at Tikur Anbessa Specialized Hospital Addis Ababa, Ethiopia, *Ethiopian Medical Journal*, **46**, no. 3, 227–235, (2008).

[3] B. Christensen, Which antibiotics are appropriate for treating bacteriuria in pregnancy? *Journal of Antimicrobial Chemotherapy*, **46**, no. 1, 29–34, (2000).

[4] B. Foxman, Epidemiology of urinary tract infection: incidence morbidity and economic costs, *Dis Mon*, **49**, no. 2, 53–70, (2003).

[5] Z. Hamdan Hamdan, M. Ziad Abdel Haliem, K. Ali Salah, and Adam Ishag, Epidemiology of urinary tract infections and antibiotics sensitivity among pregnant women at Khartoum North Hospital, *Annals of Clinical Microbiology and Antimicrobials*, **10**, no. 22, 132–137, (2011).

[6] E. H. Kass, Pregnancy, pyelonephritis and prematurity, *Clinical Obstetrics and Gynecology*, **13**, no. 2, 239–254, (1970).

[7] A. Masinde, B. Gumodoka, A. Kilonzo, and S. E. Mshana, Prevalence of urinary tract infection among pregnant women at Bugando Medical Centre, Mwanza, Tanzania, *Tanzania Journal of Health Research*, **11**, no. 3, 154–159, (2009).

[8] E. Mazor-dray, A. Levy, E. Sheine, et al., Maternity urinary tract infection: Is it independently associated with adverse pregnant outcome, *Journal of Maternal-Fetal and Neonatal Medicine*, **22**, no. 2, 124–128, (2009).

[9] M. S. Mikhail and A. Anyaegbunam, Lower urinary tract dysfunction in pregnancy: A review, *Obstetrical and Gynecological Survey*, **50**, no. 9, 675–683, (1995).

[10] Mohamed A. Fareid, Frequency and susceptibility profiles of bacteria causing urinary tract infection among women, *New York Science Journal*, **5**, no. 2, 284–298, (2012).

[11] M. E. Murtaza, Urinary tract infection in pregnancy. A survey in women attending antenatal clinic in Kenyatta national hospital by Murtaza muzaffer Essajee-2002. M.Med (obs/gyn) Thesis University of Nairobi (2002), (unpublished).

[12] C. O. Njoku, N. H. Ezissi, A. N. Amandi, et al., Observations on bacterial infection of urinary tract patients, *International Journal of Environmental Health and Human Development*, **13**, no. 2, 785–791, (1998).

[13] I. O. Okonko, L. A. Ijandipe, A. O. Ilusanya, O. B. Donbraye-Emmanuel, J. Ejembi, A. O. Udeze, O. C. Egun, A. Fowotade, and A. O. Nkang, Detection of Urinary Tract Infection (UTI) among pregnant women in Oluyoro Catholic Hospital, Ibadan, South-Western Nigeria, *Malaysian Journal of Microbiology*, **6**, no. 1, 16–24, (2010).

[14] L. M. Pastore, D. A. Savitz, J. M. Thorp Jr., G. G. Koch, I. Hertz-Picciotto, and D. E. Irwin, Predictors of symptomatic urinary tract infection after 20 weeks' gestation, *Journal of Perinatology*, **19**, no. 7, 488–493, (1999).

[15] T. F. Patterson and V. T. Andriole, Bacteriuria in pregnancy, *Infectious Disease Clinics of North America*, **1**, no. 4, 807–822, (1987).

[16] S. J. Moyo, S. Aboud, M. Kasubi, and S. Y. Maselle, Bacterial isolates and drug susceptibility patterns of urinary tract infection among pregnant women at muhimbili national hospital in Tanzania, *Tanzania Journal of Health Research*, **12**, no. 4, 236–240, (2010).

[17] A. Schulman and H. Herlinger, Urinary tract dilatation in pregnancy, *British Journal of Radiology*, **48**, no. 572, 638–645, (1975).

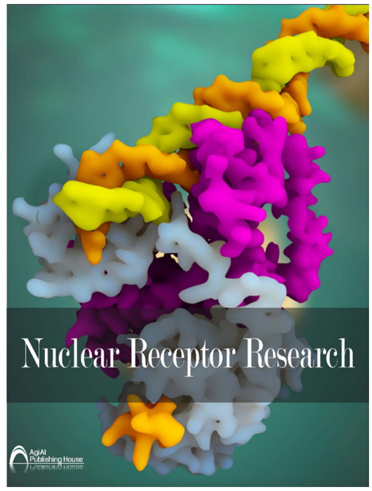
[18] S. R. Dimetry, H. M. El-Tokhy, N. M. Abdo, M. A. Ebrahim, and M. Eissa, Urinary tract infection and adverse outcome of pregnancy, *The Journal of the Egyptian Public Health Association*, **82**, no. 3-4, 203–218, (2007).

[19] L. A. Shieve, A. Handler, R. Hershow, et al., Urinary tract infection in pregnancy, *J Repro Med*, **3**, 123–126, (1986).

[20] J. C. Vazquez and J. Villar, Treatments for symptomatic urinary tract infections during pregnancy, *Cochrane Database of Systematic Reviews (Online)*, no. 3, p. CD002256, (2000).

Nuclear Receptor Research

About the Journal



100% Free of Charge

Nuclear Receptor Research is a peer-reviewed open access journal that publishes high-quality, original research and review articles covering all aspects of research involving all members of the nuclear receptor superfamily.

The editorial board of *Nuclear Receptor Research* has over 70 scientists representing a wide-scope of interest and expertise in the field, from 20 countries around the world.

Nuclear Receptor Research has a fully automated Manuscript Management System (MMS) which makes submission and reviewing as well as tracking of manuscripts an easy, efficient and prompt process to the advantage of the authors. Published articles in *Nuclear Receptor Research* are available in different formats including full-text HTML, full-text PDF, full-text ePUB, full-text XML, and Mobi.

Free Advertising

100% Free of Charge

Advertise, in *Nuclear Receptor Research*, positions available in your laboratory, a position you are seeking, supplies and equipment as well as meetings and conferences related to the field of nuclear receptor research.

For more information about advertising in *Nuclear Receptor Research* please visit the journal website at: http://www.agialpress.com/journals/nrr/

For advertising in *Nuclear Receptor Research* please send your ad to nrr.ad@agialpress.com

Contact

Editor-in-Chief: badrm@umkc.edu
Editorial Office: nrr@agialpress.com

AgiAl Publishing House
http://www.agialpress.com/