

Prevalence and etiologic agents of female reproductive tract infection among in-patients and out-patients of a tertiary hospital in Benin city, Nigeria

Richard Omoregie, M.Phil., FIMLS.¹, Christopher Aye Egbe, M. Phil., AIMLS.²,
Isaac Ohiorenuan Igbarumah, B.MLS., AIMLS.², Helen Ogefere, Ph.D., FIKLS.³, Evelyn Okorie, M.Sc., FIMLS.²

¹School of Medical Laboratory Sciences, and ²Department of Medical Microbiology,
University of Benin Teaching Hospital, P.M.B. 1111, Benin City, Edo State, Nigeria.

³Department of Medical Laboratory Science, School of Basic Medical Sciences, University of Benin,
Benin City, Nigeria.

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Abstract

Background: Reproductive tract infections are public health problems in women of reproductive age and can result in serious consequences if not treated. **Aims:** To determine the prevalence and causes of reproductive tract infections among in-patients and out-patients attending a tertiary health institution in Benin City. The antimicrobial susceptibility profiles of bacterial agents will also be determined. **Patients and Methods:** High vaginal swabs or endocervical swabs and blood were collected from 957 patients consisting of 755 out-patients and 202 in-patients. The swabs were processed and microbial isolates identified using standard technique. Disc susceptibility tests were also performed on microbial isolates. The blood samples were used for serological diagnosis of syphilis. **Results:** There was no significant difference in the prevalence of female reproductive tract infections between in-patients (52.48%) and out-patients (47.02%), although in-patients showed a significantly higher risk of developing mixed infections (in-patients vs. out-patients; 34.91% vs. 22.25%, OR = 1.873 95% CI = 1.169, 3.001; P = 0.01). *Candida albicans* was the most prevalent etiologic agent among out-patients studied while *Staphylococcus aureus* was the most prevalent etiologic agent among in-patients. *Trichomonas vaginalis* was observed only among out-patients. Ceftriaxone, ciprofloxacin and ofloxacin were the most active antibacterial agents. Syphilis was not detected in any patient. **Conclusion:** An overall prevalence of 48.17% of female reproductive tract infection was observed among the study population. Although there was no significant difference between in-patients and out-patients, in-patients appeared to have 1-3-fold increase risk of developing mixed infections. The most prevalent etiologic agent differs between in-patients and out-patients. Despite the high activity of ceftriaxone, ciprofloxacin and ofloxacin against bacterial isolates from both in-patients and out-patients, prudent use of antibacterial agents is advocated.

Keywords: Female reproductive tract infection, etiologic agents, prevalence.

Correspondence to: Richard Omoregie, School of Medical Laboratory Sciences, University of Benin Teaching Hospital, P.M.B. 1111, Benin City, Edo State, Nigeria. Tel.: +2348029582386, E-mail: richyomos@yahoo.com.

Introduction

Reproductive tract infections (RTIs) are recognized as a public health problem and rank second - after maternal

morbidity and mortality - as the cause of healthy life loss among women of reproductive age in developing countries [1]. Reproductive tract infections include endogenous infections, iatrogenic infections and sexually transmitted

infections (STIs) [2]. If left untreated, RTIs can cause the following serious consequences: infertility, ectopic pregnancy, cervical cancer, menstrual disturbances, pregnancy loss and low birth weight babies. The presence of RTIs (especially ulcer-causing sexually transmitted infections) can promote the acquisition and transmission of the human immunodeficiency virus [3].

The prevalence of RTIs has been shown to vary, both among countries and among different groups within the same country [4]. There is therefore need to determine the epidemiology of RTIs by periodically monitoring the prevalence of etiologic agents. To our knowledge, the prevalence and causative agents of RTIs among female in-patients and out patients have not been documented in our locality. Therefore, this study aims to determine the prevalence and etiologic agents of reproductive tract infections among female in-patients and out-patients in a tertiary hospital in Benin City, Nigeria. The susceptibility profile of bacterial isolates will also be determined.

Patients and Methods

Study population

A total of 957 women consisting of 755 out-patients and 202 in-patients with age ranging from 16 to 69 years were recruited for this study. All out-patients were attending Obstetrics and Gynecology clinic while in-patients were on admission, both in University of Benin Teaching Hospital. The University of Benin Teaching Hospital is a tertiary hospital with referral status. All patients had signs and symptoms of reproductive tract infection. The study was carried out between August, 2007 and December, 2009. Verbal informed consent was obtained from each patient prior to specimen collection. This study was approved by the Ethical Committee of the University of Benin Teaching Hospital.

Collection and processing of sample

High vagina swab (HVS) or endocervical swab (ECS) and blood specimens were collected from each patient. A pair of HVSs or ECSs was collected from each subject. The blood samples (5 ml) were placed in plain containers and allowed to clot. The serum obtained was used to diagnose syphilis by detecting antibodies to *Treponema pallidum* using an immunochromatographic immunoassay kit (Acumen Diagnostic test, India) following the manufacturer's instructions.

One of the HVS/ECS was used to make film and stained by Gram stain as well as wet mount. The second swab was cultured onto chocolate agar, blood agar, MacConkey agar and Sabouraud agar, and incubated for 24 – 48 hours. Gonorrhoea was diagnosed by presence of intracellular Gram negative diplococci and/or identification of the isolate from culture. Candidiasis was diagnosed by the presence of yeast-like cells in wet mount as well as identification of isolate from culture. *Trichomonas vaginalis* was identified by its typical morphology and motility on wet mount of either HVS of ECS specimen.

Bacterial isolates were identified using standard techniques [5]. Antibacterial susceptibility profiles were performed using a method previously described [6].

Statistical analysis

The data obtained were analyzed using Chi square (X^2) and odd ratio analysis using the statistical software INSTAT[®].

Results

There was no significant difference between female in-patients (52.48%) and out-patients (47.02%) ($P = 0.19$) with regard to the prevalence of reproductive tract infections. However, in-patients had a significantly higher risk of developing mixed infections than their out-patient counterparts (in-patients vs. out-patients; 34.91% vs. 22.25% OR = 1.873 95% CI = 1.169, 3.001; $P = 0.01$, Table 1).

Table 1 Prevalence of female reproductive tract infections among in-patients and out-patients

	In-patient	Out-patient	Total
Number tested	202	755	957
Number infected*	106 (52.48%)	355 (47.02%)	461(48.17%)
Number with mixed infection†	37 (34.91%)	79 (22.25%)	116 (25.16%)

* In-patient vs. out-patients: OR = 1.244 95% CI = 0.912, 1.698; $P=0.19$, †Mixed infections: OR = 1.873 95% CI = 1.169, 3.001; $P = 0.01$.

Candida albicans was the predominant etiologic agent of reproductive tract infections among female out-patients while *Staphylococcus aureus* was the predominant etiologic agent among female in-patients. *Trichomonas vaginalis* and *Pseudomonas aeruginosa* were recovered only from out-patients. Generally, *Candida albicans* was the most prevalent microbial agent followed by *Staphylococcus aureus*, while *Pseudomonas aeruginosa* was the least-encountered agent, with a prevalence of 0.14% (Table 2).

Table 2 Prevalence of etiologic agents of reproductive tract infections

Organisms	In-patient (%)	Out-patient (%)	Total (%)
<i>Escherichia coli</i>	14 (9.72)	30 (5.48)	44 (6.37)
<i>Klebsiella</i> species	2 (1.39)	31 (5.67)	33 (4.78)
<i>Enterobacter</i> species	1 (0.69)	6 (1.20)	7 (1.01)
<i>Proteus mirabilis</i>	12 (8.33)	10 (1.83)	22 (3.18)
<i>Proteus vulgaris</i>	2 (1.39)	6 (1.20)	8 (1.16)
<i>Providencia</i> species	6 (4.17)	26 (4.75)	32 (4.63)
<i>Acinetobacter</i> species	1 (0.69)	3 (0.55)	4 (0.58)
<i>Alkaligenes</i> species	6 (4.17)	2 (0.37)	8 (1.16)
<i>Pseudomonas aeruginosa</i>	0 (0.00)	1 (0.18)	1 (0.14)
<i>Staphylococcus aureus</i>	58 (40.28)	184 (133.64)	242 (35.02)
<i>Enterococcus faecalis</i>	4 (2.78)	2 (0.37%)	6 (0.87)
<i>Candida albicans</i>	37 (35.69)	244 (44.61)	81 (40.70)
<i>Trichomonas vaginalis</i>	0. (0.00)	2 (0.37)	2 (0.29)
Total	143 (20.72)	547(79.28)	690

There was no definite antimicrobial susceptibility pattern

observed between isolates from in-patients when compared with those from out-patients (Tables 3 and 4). However, ceftriaxone, ciprofloxacin and ofloxacin were the most active antibacterial agents against isolates from

both in-patients and out-patients. With the exception of 5.17% of *Staphylococcus aureus* strains from in-patients, chloramphenicol and tetracycline showed no activity against the bacterial isolates.

Table 3 Susceptibility profile of bacterial isolates from in-patients

Organisms	Antibacterial disc (µg/disc)											
	CRO (30)	CIP(30)	OFX (5)	C (10)	CN (10)	SXT(25)	AUG(30)	AMX(30)	E (5)	TE(10)	OB (5)	CAZ(30)
<i>Escherichia coli</i> (n=14)	14(100%)	14(100%)	14(100%)	0(0.00%)	11(78.57%)	0(0.00%)	7(50.00%)	11(78.57%)	ND	0(0.00%)	ND	12(85.71%)
<i>Klebsiella</i> species (n=2)	2(100%)	2(100%)	2(100%)	0(0%)	1(50%)	0(0%)	1(50%)	1(50%)	ND	0(0%)	ND	2(100%)
<i>Enterobacter</i> species (n=1)	1(100%)	1(100%)	1(100%)	0(0%)	1(100%)	1(100%)	1(100%)	1(100%)	ND	0(0%)	ND	1(100%)
<i>Proteus mirabilis</i> (n=12)	12(100%)	9(75%)	12(100%)	0(0%)	7(58.33%)	0(0%)	9(75%)	10(83.33%)	ND	0(0%)	ND	8(66.67%)
<i>Proteus vulgaris</i> (n=2)	2(100%)	2(100%)	2(100%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	ND	0(0%)	ND	0(0%)
<i>Providencia</i> species (n=6)	5(83.33%)	3(50%)	5(83.33%)	0(0%)	3(50%)	0(0%)	3(50%)	3(50%)	ND	0(0%)	ND	3(50%)
<i>Acinetobacter</i> species (n=1)	1(100%)	1(100%)	1(100%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	ND	0(0%)	ND	0(0%)
<i>Alcaligenes</i> species (n=6)	5(83.33%)	5(83.33%)	6(100%)	0(0%)	2(33.33%)	0(0%)	3(50%)	4(66.67%)	ND	0(0%)	ND	4(66.67%)
<i>Staphylococcus aureu</i> (n=58)	35(60.34%)	27(46.55%)	39(67.24%)	3(5.17%)	9(15.52%)	0(0%)	21(36.21%)	18(31.03%)	0(0%)	0(0%)	4(6.9%)	35(60.34%)
<i>Enterococcus faecalis</i> (n=4)	4(100%)	3(37%)	4(100%)	0(0%)	2(50%)	0(0%)	1(25%)	2(50%)	0(0%)	0(0%)	0(0%)	2(50%)

CRO: Ceftriaxone, CIP: Ciprofloxacin, C: Chloramphenicol, CN: Gentamicin, SXT: Sulfamethoxazole-trimethoprim, AUG: Amoxicillin-clavulanate, AMX: Amoxicillin, E: Erythromycin, TE: Tetracycline, OB: Cloxacillin, CAZ: Ceftazidime, ND: Not done.

Table 4 Susceptibility profile of bacterial isolates from out-patients

Organisms	Antibacterial disc (µg/disc)											
	CRO (30)	CIP(30)	OFX (5)	C (10)	CN (10)	SXT(25)	AUG (30)	AMX (30)	E (5)	TE (10)	OB (5)	CAZ (30)
<i>Escherichia coli</i> (n=30)	27(90)	24(80%)	29(96.6%)	0(0%)	22(93.3%)	0(0%)	24(8%)	24(0%)	N	10(3.33%)	N	6(36.67%)
<i>Klebsiella</i> species (n=31)	28(90.32%)	24(77.42%)	29(93.55)	0(0%)	22(70.97%)	9(29.03%)	19(61.29%)	22(70.97%)	ND	0(0%)	ND	24(77.42%)
<i>Enterobacter</i> species (n=6)	4(66.67%)	0(0%)	4(66.67%)	0(0%)	1(16.67%)	0(0%)	1(16.67%)	1(16.67%)	ND	0(0%)	ND	2(33.33%)
<i>Proteus mirabilis</i> (n=10)	8(80%)	4(40%)	8(80%)	0(0%)	0(0%)	5(50%)	4(40%)	5(50%)	ND	0(0%)	ND	6(60%)
<i>Proteus vulgaris</i> (n=6)	4(66.67%)	2(33.33%)	4(66.67%)	0(0%)	1(16.67%)	0(0%)	2(33.33%)	2(33.33%)	ND	0(0%)	ND	2(33.33%)
<i>Providencia</i> species(n=26)	24(92.31%)	20(76.92%)	24(92.31%)	0(0%)	20(76.92%)	0(0%)	21(80.77%)	21(80.77%)	ND	0(0%)	ND	22(84.62%)
<i>Acinetobacter</i> species(n=3)	2(66.66%)	1(33.33%)	3(100%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	ND	0(0%)	ND	0(0%)
<i>Alcaligenes</i> species (n=2)	0(0%)	0(0%)	2(100%)	0(0%)	0(0%)	0(0%)	0(0%)	1(50%)	ND	0(0%)	ND	1(50%)
<i>Pseudomonas aeruginosa</i> (n=1)	0(0%)	1(100%)	1(100%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	ND	0(0%)	ND	0(0%)
<i>Staphylococcus aureus</i> (n=184)	165(89.67%)	151(82.07%)	171(92.93%)	0(0.00%)	55(29.89%)	0(0.00%)	145(78.80%)	147(79.89%)	0(0.0%)	0(0.00%)	0(0.00%)	148(80.43%)
<i>Enterococcus faecalis</i> (n=2)	2(100%)	2(100%)	2(100%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)

CRO: Ceftriaxone, CIP: Ciprofloxacin, C: Chloramphenicol, CN: Gentamicin, SXT: Sulfamethoxazole-trimethoprim, AUG: Amoxicillin-clavulanate, AMX: Amoxicillin, E: Erythromycin, TE: Tetracycline, OB: Cloxacillin, CAZ: Ceftazidime.

Discussion

Reproductive tract infections (RTIs) are considered a global public health issue and in resource-poor countries, they are among the 5 most common health problems leading to contact with the health system [7]. The prevalence of RTIs has been reported to vary from country to country as well as among different groups within the same country [4]. Monitoring of the prevalence of etiologic agents is necessary to enhance our knowledge of

its epidemiology. This was the basis for this study.

The study revealed no significant difference between female in-patients and out-patients with respect to the prevalence of RTIs. To our knowledge, although a majority of studies on RTIs have been conducted in hospitals and clinics [8], they characterized the patients as either in-patients or out-patients. RTIs are among the nosocomial infections and the data indicates that inpatient

prevalence does not differ from that seen in out-patients. However, in-patient status was a significant risk factor for acquiring mixed RTIs (OR = 1.873 95%, CI 1.169, 3.001 P = 0.01). These nosocomial infections may be endogenous and arise from frequent use of antibiotics; alternatively, they could be iatrogenic as a result of induced abortion or a combination of both [9]. This may explain the increase prevalence of multiple infections among in-patients. An overall 48.17% prevalence of microbiologically-proven RTIs was observed in this study. This is lower than the 54.4% observed in Vietnam [7]. However, the Hng study patients were strictly those seeking abortion whereas this study encompassed all patients with signs and symptoms of RTIs. Also, it has been reported that the prevalence of RTIs differ from country to country [4]. This may explain the differences in both studies.

The etiologic agents of RTIs observed in this study differed between in-patients and out-patients. Sexually transmitted infection (Trichomoniasis) was observed only among out-patients. *Candida albicans* was the most prevalent pathogen among out-patients (44.61%) while *Staphylococcus aureus* was the most prevalent pathogen among in-patients (40.28%). The finding that out-patients had more prevalence of Candidiasis agrees with earlier reports [7,10,11]. However, it disagrees with a recent report [1] which found bacterial vaginosis as the most prevalent RTI in their study. Geographical location and setting may be the reason for the difference, as the Jindal *et al.* [1] study was conducted among a rural population in India. It is important to note that etiologic agents of STIs such as *N. gonorrhoeae*, *Chlamydia Trachomatis*, *Treponema pallidum* and endogenous agents of bacterial vaginosis were not detected in this study. *Chlamydia trachomatis* is understandable as it was not screened for in this study. The prevalences of gonorrhoea and syphilis have been reported to be very low (1.7 and 1.3% respectively) among pregnant women in Ilorin, Nigeria [11]. In North-Eastern Nigeria, a prevalence of 0.4% of syphilis was reported [12]. In our setting, *N. gonorrhoeae* has not been isolated for years while no more than 4 cases of seropositive syphilis have been reported per year. This may explain their non-detection in this study. The other recovered isolates showed endogenous and iatrogenic source of infection.

It is expected that nosocomial isolates would be more antimicrobially resistant than community isolates. However, this was not observed in this study in which ceftriaxone, ciprofloxacin and ofloxacin were the most active antibacterial agents against isolates from both in-patients and out-patients. Ciprofloxacin and ofloxacin are contraindicated in pregnancy, thereby limiting therapeutic options. Furthermore, prescriptions of antibiotics without laboratory guidance as well as over the counter sales of antibiotics without prescription are rife in Nigeria. Both practices have been implicated as possible reasons for increased antimicrobial resistance observed across the nation [13,14].

Conclusion

An overall prevalence of 48.17% of RTIs in females was observed, with in-patients shown to be more at risk for developing mixed reproductive tract infections. *Candida albicans* was the most predominant isolate associated with reproductive tract infections in females generally and among out-patients while *Staphylococcus aureus* was the most prevalent etiologic agent among in-patients. The cases of sexually-transmitted infection (Trichomoniasis) were observed only among out-patients. Although ceftriaxone, ciprofloxacin and ofloxacin were the most active antibacterial agents, prudent use of antibiotics is advocated to prevent future development of resistance.

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