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Research Article

Neisseria gonorrhoeae and their Antimicrobial Susceptibility Patterns among Patients from Adama Town, Ethiopia

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ABSTRACT

Neisseria gonorrhoeae is a gram negative coffee-bean shaped intracellular diplodocus bacterium that causes gonorrhea which is one of the sexually transmitted infections. Antibiotic resistant, *Neisseria gonorrhoeae* is emerging in many parts of the world, especially in developing countries; antimicrobial resistance to the commonly prescribed antibiotics. A cross-sectional study was conducted on 422 study participant sexually transmitted infections suspected patients attending Adama Hospital Medical College. Then, samples was transported to Oromia Public Health Research Capacity Building Quality Assurance Laboratory and processed following standard microbiological culture techniques. Antimicrobial susceptibility test was performed. In this study 16(3.8%) of the STI suspected patients were confirmed to have *Neisseria gonorrhoeae*. Most of the participants were females, multiple sex partners (p=0.001) were associated with increased odds of 42 infection. All *Neisseria gonorrhoeae* isolates were susceptible to ceftriaxone and cefoxitin 16(100%) but all were resistant to penicillin and tetracycline. In this study 16(3.8%) of the STI suspected patients were confirmed to have *N. gonorrhoeae*. Hence, prevention efforts should consider behavioral risk reduction.

Keywords: *Neisseria gonorrhea*; Antimicrobial susceptibility pattern; Patients

INTRODUCTION

Neisseria gonorrhoeae is a Sexually Transmitted Infections (STI) caused by the bacterium *Neisseria gonorrhoeae*, and humans act a reservoir host. *N. gonorrhoeae* is a non-motile, non-spore-forming aerobic gram-negative diplodocus that grows in pairs, or diploes, adopting a similar morphology to that of coffee beans, and has two genome libraries were with a mean insert size of 32 kb and other had a size of approximately 1 kb to 2 kb. *N. gonorrhoeae* is a nutritionally demanding and labile organism that requires an atmosphere enriched with 5%CO2, a temperature between 35°C and 37°C, and a pH between 6.5 and 7.5 for isolation in culture [1-4].

Neisseria gonorrhoeae is one of the classical sexually transmitted infections (STIs), that can also be transmitted from mother to child during delivery and cause infection of the eye of the newborn [5,6]. Gonorrhea is a major cause of urethritis in men and cervicitis in women; the latter can result in pelvic inflammatory disease (PID), infertility, ectopic pregnancy, fetal wastage, neonatal ophthalmic and disseminated gonococcal infections and chronic pelvic pain. Extra genital infections of the pharynx and rectum are prevalent in certain groups, such as men who have sex with men. Invasive infections with *Neisseria gonorrhoeae*, including disseminated gonococcal infection, endocarditic, and meningitis, are uncommon but can result in serious morbidity. Gonococcal resistance to several classes of antimicrobial agents is widespread. The growing threat of antimicrobial resistance in *Neisseria gonorrhoeae* highlights a great deal of attention has focused on outer membrane proteins P-III since, in human infection, antibody to P-III blocks serum killing of certain strains of GC, in addition, antibody to P-III induced by previous gonococcal infection increases ones susceptibility to gonorrhea and the importance of ensuring the availability of appropriate diagnostic modalities for surveillance [6,7].

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Neisseria gonorrhoeae has progressively developed resistance to each of the antimicrobials used for treatment of gonorrhea. Most recently, declining susceptibility to cefixime (an oral cephalosporin antibiotic) resulted in a change to the CDC treatment guidelines, so that dual therapy with ceftriaxone (an inject able cephalosporin) and azithromycin is now the only CDC-recommended treatment regimen for *Neisseria gonorrhoeae*. The emerging threat of cephalosporin resistance highlights the need for continued surveillance of *Neisseria gonorrhoeae* antimicrobial susceptibility [6,8].

Antimicrobial resistant strains of *Neisseria gonorrhoeae* have spread with remarkable rapidity in many African countries. Chromosomal-mediated resistance to penicillin, tetracycline, and thiamphenicol is frequent now, and reported prevalence's of penicillinase-producing N. gonorrhea isolates vary between 15% and 80%. Plasmid-mediated tetracycline-resistant *N. gonorrhoeae* isolates have been observed in several African countries [1,4].

There was no adequate information about antimicrobial resistance status of *N. gonorrhoeae*. The merging epidemics of STI and *N. gonorrhoeae* have raised concerns by many experts but no large scale screening and intervention have been launched yet, especially in low-income countries like Ethiopia [6,8]. As a result, Ethiopia is facing this burden of *N. gonorrhoeae* among STI, and still there are inadequate studies in identifying the associated factor and their drug Susbtability patterns in Adama Hospital Medical college. Accordingly, this study was carried out to determine prevalence, drug susceptibility and associated factors among STI suspected *Neisseria gonorrhoeae* infected patients. The objectives of this study is to the assess antimicrobial susceptibility patterns of *N. gonorrhea* infection among sexually transmitted infections (STI) patients at Adama Hospital Medical College from December 2017 to March/30/2018.

MATERIALS AND METHODS

A cross-sectional study was conducted from December 2017 to March, 30/2018 in Adama town, SouthEast Ethiopia. The Town is 100 km away from Addis Ababa, Ethiopia, located in the Zone of the Oromia Region. Based on the 2017 Adama town administrative health office information gathered, this town has a total population 341,974 of whom male 172,696.87 (50.5%) and female 169277.13 (49.5%) (Adama town health office planning program). Based on the 2017 Adama town administrative health office information gathered, this town has a total population 341,974 of whom male 172,696.87 (50.5%) and female 169277.13 (49.5%) (Adama town health office planning program). Descriptive statistics, including socio-demographics factors and known risk factors for STI were performed.

Inclusion and exclusion criteria

Inclusion criteria: STI patients suspected for *N. gonorrhea* Infection 15 to 49 years age attending Adama Hospital Medical College during study period.

Exclusion criteria: Those patients who were taking antibiotic for one week and critically sick and unable to Communicate during the study period were excluded from the study.

Sample size determination

Sample size was determined by single population proportion formula using prevalence of 11.3% a study conducted in our country at Gambela Referral Hospital 2016 [9,10], margin of error (d) taken to be 3%, at the confidence level of 95%. The final sample size was calculated by the formula.

$$N=[(Z\alpha/2)^2*p*(1-p)]/d^2$$

$$N=[(1.96) ^2*0.113*(1-0.113))/(0.03)^2=427$$

Z=1.96 for 95% confidence interval

d=0.03 margin of error, prevalence i used was low, then to increase the sample size i used 0.03 margin of error.

p=0.113 which is prevalence of *N. gonorrhoea* among STI patients from previous study.

n=sample size study population

To compensate the possible non response, 10% contingency was added to give the final sample size of 470.

Data collection procedure

Socio-demographic characteristics: After taking written informed consent from each study participant, a semi-structured questionnaire was used to collect socio-demographic and clinical data needed in this study. Data were collected by trained nurses.

Methods of data collection: The data collector or interviewer was given full information including medical assistant and clinician working in STI clinic for Adama Hospitals Medical College found in Adama town. Structured questionnaires were able to explore the objectives of this study to design for interviewing and urethral and cervical swab collection of from STI suspected patients. After the patients left STI clinic, an interviewers approach to the STI patients as if he or she will voluntary talk about the visit and service he or she received to inform about the study and willingness of the patients.

Antimicrobial susceptibility testing: Antimicrobial susceptibility testing was performed for all isolates according to the criteria of Clinical and Laboratory Standard Institute (CLSI) by the Kirby-Bauer disk diffusion method [11]. Bacterial suspensions with turbidity standard equivalent to McFarland 0.5 will be swabbed evenly on GC-chocolate agar with 1% Vitox supplement. A set of five antibiotic discs (Oxoid Ltd., Basingstoke, Hampshire, England) with the following concentrations: tetracycline 30 µg, penicillin 10 IU, ciprofloxacin 5 µg, cefexitin 30 µg and ceftriaxone 30 µg was placed on the surface of the plate. Then, the plates were incubated at 37°C in candle jar, generating 5–10% CO2, for 20–24 h [6].

Zone of inhibition diameters in mm were measured and interpreted as sensitive, intermediate and resistant according to the principles established by CLSI 2014 version. In order to

monitor quality (potency) of disks, a standard strain of *N. gonorrhoeae* American Type Culture Collection (ATCC) 49226 was tested at regular interval. The tested antibiotics were selected based on the national list of medicines by Food, Medicine and HealthCare Administration and Control Authority (FMHACA) Ethiopia in 2010 to treat infections, Syndrome management package for the management of sexually transmitted infections, Federal democratic republic of Ethiopia and prescription frequencies [10,11].

RESULTS

Antimicrobial susceptibility pattern of *N. gonorrhoeae* among STI suspected patients

The antimicrobial susceptibility pattern among 16(3.8%) *N. gonorrhoeae* identified by Culture and drug sensitivity and resistant pattern performed by direct disc diffusion method (Table 1). From these 16(100%) were sensitive for Ceftriaxone and Cefixime. All 16(100%) were resistance for Penicillin, Tetracycline and Deoxacillin and 3(18.75%) were resistance for Ciprofloxacin.

Table 1: Antimicrobial drug resistance patterns of *N. gonorrhoeae* isolates from STI suspected patients at AHMC Oromia, Ethiopia (December 2017 –March 2018).

Organism	Pattern	Drugs tested No (%)					
		FOX	CRO	CIP	P	T	remark
N. gonorrhea (n=16)	S	16 (100)	16(100)	12(75)	0(0)	0(0)	
	I	0	0	0	0	0	
	R	0	0	4(25)	16(100)	16(100)	
Total							

S: Sensitive; I: Intermediate; R: Resistant; FOX: Cefixime; CRO: Ceftriaxone; CIP: Ciprofloxacin; P: Penicillin; T:Tetracycline

DISCUSSION

Antibiotic Susceptibility pattern was done by using direct disc diffusion method for *N. gonorrhoeae* infection identified. From those 16(100%) were sensitive to both Ceftriaxone, and Cefixime, 16(100%) were resistant, to Tetracycline, Penicillin and 3(18.75%) were resistant to Ciprofloxacin). This was comparable with study done in Gambela Hospital, and study conducted at Hawasa Referral Hospital, Bahir Dar and Jimma hospital [6-12].

Variables likes, drinking alcohol, Number of sexual partners, sex, condom usage during sexual intercourse, HIV status of study participants, were analyzed by Bivariate and determinate for *N. gonorrhoeae* infection but variables like, age, cigarette smoking, and residence were not determinate risk factors with *N. gonorrhoeae* infection. So to minimize the confounding factors I took the variables which having p-value<0.2 and below by binary logistic regression, after adjusting for possible confounding factors for those. Variables such as, monthly income, occupation and history of cigarette smoking were dropped from multivariate binary logistic regression analysis because the p-value were>0.05.

STI patients in sex category of study participant, males were (AOR=11.066; 95%CI=2.737-44.737, p=0.001) more likely to develop *N. gonorrhoeae* infection than females, similarly STI patients those who had two and more sexual partner were more than (AOR=42.453; 95%CI=5.54-0.325.289; p=0.001) more likely to develop with *N. gonorrhoeae* infection than who had one sexual partner, also STI patients those having HIV positive were about 0.080(AOR, 0.080; 95%CI: 0.019-0.334; p=0.001) more likely to developed *N. gonorrhoeae* infections than HIV negative STI patients. Participant who had not used condom during intercourse 27.302(AOR, 27.302; 95% CI: 3.453-215.844; p=0.002) more likely infected with *N. gonorrhoeae* than who had used condom during intercourse.

CONCLUSION AND RECOMMENDATION

N. gonorrhoeae infections antibiotic susceptibility test 16(100%) were sensitive to both Ceftriaxone and Cefixime, 16(100%) were resistant Tetracycline and Penicillin, 3(18.75%) were resistant to Ciprofloxacin. Awareness creation for STI patients about risk of N. gonorrhoeae infections and need for screening should be implemented by Adama town health office and AHMC. Also Additional study should be done on why the facilities not used culture base *N. gonorrhoeae* diagnosis.

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