Strain diversity and antimicrobial susceptibility of *Neisseria gonorrhoeae* in Mwanza and Ngara Districts, Tanzania

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Abstract: The objective of the study was to determine strain types and antimicrobial susceptibility patterns of Neisseria gonorrhoeae isolates from different population groups. Six different population groups were studied, male and female urban STD clinic attendees, antenatal clinic attendees, women attending a newly opened women centre, and commercial sex workers in Mwanza town plus male Rwandan refugees from Ngara with symptoms of urethritis. Gonococci isolated were tested for susceptibility to a panel of antimicrobials using standard procedures. Penicillinase production, which gives the gonococci ability to resist killing by penicillin was detected in 25 to 74% of isolates. The majority of gonococcal isolates were resistant to tetracycline and chloramphenicol. 9% and 22% of the strains isolated from patients attending Mwanza and Ngara clinics respectively, were resistance to cotrimoxazole. Resistance to erythromycin was found in 5% of isolates from all population groups. Strains from all population groups were susceptible to ceftriaxone, cefuroxime, spectinomycin, norfloxacin and ciprofloxacin. The susceptibility of all isolates to spectinomycin observed supports the policy decision to change from co-trimoxazole to spectinomycin as one of the first line drugs in the syndromic management of genital discharge.

Introduction

The success of a Sexually Transmitted Diseases (STDs) control programme depends on effective treatment regimens. However, to achieve and maintain a high level of efficacy, the knowledge of the current local bacteria susceptibility pattern to antibiotics is of utmost importance. This is because the susceptibility to antibiotics, especially for *Neisseria gonorrhoeae* changes over time and shows a wide geographical variation.

High-level resistance to penicillin by *N. gonorrhoeae* was first reported in 1976 (*1,2*), and has led to wide spread resistance throughout the world. Strains of *N. gonorrhoeae* showing high level resistances to tetracyclines were first reported in 1985 and have rapidly spread (*3*). *N. gonorhoeae* strains isolated in Rwanda showed high level resistance to penicillin, tetracyclines and chloramphenicol (*4*). High-level resistance to tetracycline was also detected in 35% of gonococcal isolates in Mwanza (5).

Antibiotics currently being recommended by the World Health Organization (WHO) for management of uncomplicated gonorrhoea include ciprofloxacin, ceftriaxone, cefixime and spectinomycin. However, resistance to some of these drugs has been observed. A study on susceptibility of *N. gonorrhoeae* to antibiotics showed that 34.3% of isolates were resistant to ciprofloxacin and 0.4% and 0.6% were resistance to spectinomycin and ceftriaxone respectively (*6*).

Resistance to these drugs has also been reported in the Netherlands, United Kingdom and United States of America (*7, 8, 9*).

Since resistance to spectinomycin (the drug currently recommended for the first line treatment of gonorrhoeae in Tanzania), and other recommended drugs is emerging, there is a need to conduct regular surveillance of susceptibility of *N. gonorrhoeae* to commonly used antimicrobials.

This will be useful in appraising the continued use of these drugs, in facilitating decision on policy change on syndromic management of gonorrhoea and in detecting emerging resistance. Therefore, the objective of this study was to determine strain types and susceptibility patterns of *N. gonorrhoeae* isolates to drugs recommended for management of gonorrhoea.

Materials and methods

Patients

Swab specimens were collected from different patient groups as follows: 570 and 241 female and male STD patients respectively presenting with genital discharge at the STD clinic, Sekou Toure Hospital, and 249 females presenting with vaginal discharge at Jijenge Women Centre for sexual health, in Mwanza City. A further 294 swabs were collected from male refugees presenting with urethral discharge at the STD clinic and Outpatient Departments (OPDs) in the refugee camps in Ngara district.

Laboratory Procedures

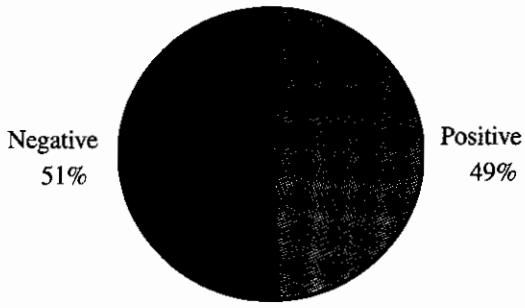
All swab specimens collected were processed for Gram staining and isolation of gonococci using standard procedures, and at standard growth conditions for *N. gonorrhoeae*. Gonococcal isolates were identified using standard tests and procedures. All gonococcal isolates were tested for ß -lactamase production, which is a marker for penicillin resistance.

All gonococcal isolates were kept at -70^0C and later used for strain typing and susceptibility testing to penicillin, cotrimoxazole, tetracycline, ciprofloxacin, spectinomycin, ceftriaxone, cefuroxime, norfloxacin, chloramphenicol and erythromycin. Susceptibility testing was done using agar dilution and E test methods, following standard procedures.

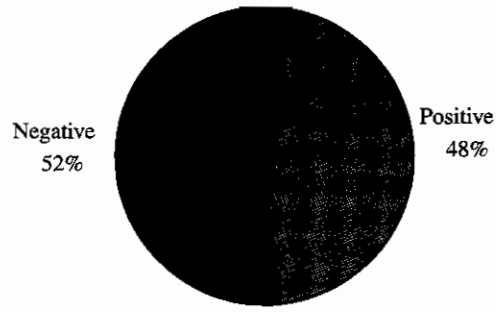
Results

The isolation rate of *N. gonorrhoeae* was highest in male STD patients (37%), followed by male STD/ OPD attendees in refugee camp (27%) and the lowest isolation rate was observed in women attending antenatal clinic (4%).

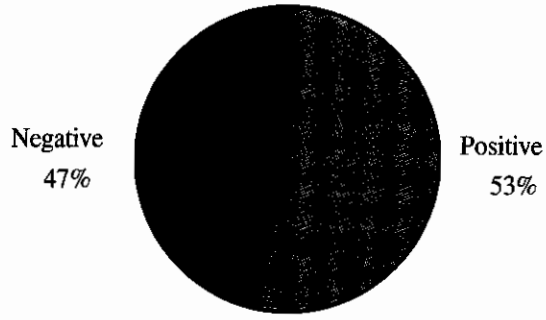
ß-lactamase positivity was highest (74%) in gonococcal isolates from commercial sex workers. Whereas â-lactamase positivity in isolates from other study groups was around 50%, ß -lactamase positivity for isolates from patients in refugee camp was 26% (Figures 1a-f).



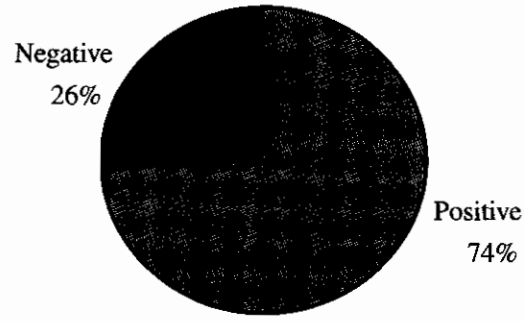
a: STD clinic males



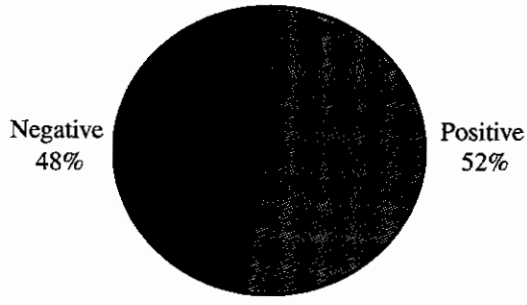
b: STD clinic females



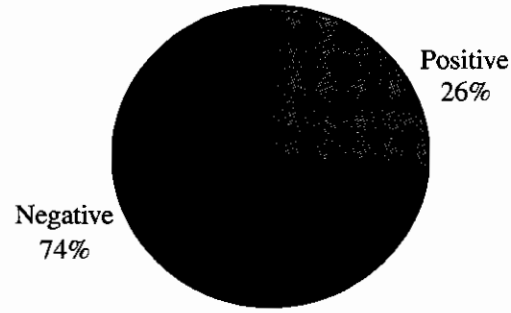
c: Antenatal clinic



d: CSW



e: Women centre



f: Refugee Camp

Figure 1: Proportion of ß - lactamase producing N. gonorrhoeae

Table 1: Percentage of *N. gonorrhoeae* isolates from different study groups showing susceptible, intermediate and resistant results to antimicrobials tested

Antimicrobial	Patient source	Susceptible	Intermediate	Resistance
Penicillin	STD clinic	7	36	57
	Jijenge	10	10	80
	Refugee camp	22	51	27
Tetracycline	STD clinic	0	4	96
	Jijenge	5	14	81
	Refugee camp	0	3	97
Cotrimoxazole	STD clinic	31	60	9
	Jijenge	29	62	9
	Refugee camp	44	34	22
Erythromycin	STD clinic	69	31	0
	Jijenge	67	28	5
	Refugee camp	73	22	5
Chloramphenicol	STD clinic	6	40	54
	Jijenge	14	28	57
Stectinomycin	All sources	100	0	0
Ciprofloxacin	STD/Jijenge	100	0	0
	Refugee camp	98	2	0
Ceftriaxone	All sources	100	0	0
Cefuroxime	STD/Jijenge	100	0	0
	Refugee camp	97	3	0
Norfloxacin	All sources	100	0	0

Although *N. gonorrhoeae* strains from all sources were sensitive to ciprofloxacin, ceftriaxone, spectinomycin and norfloxacin, strains from refugee camps showed reduced susceptibility to ciprofloxacin and cefuroxime (Table 1).

The majority of isolates were of the WII/III type, being highest in isolates from refugees (81%) and antenatal clinic attendees (80%). The proportion of WI type was high in isolates from commercial sex workers (47%) and male STD clinic attendees (42%). Strains in W1 group were more resistant than strains in the W11/111 group. A higher proportion of isolates, which were of the WI type were ß-lactamase producers and tetracycline resistant strains than isolates of the WII/III types.

Discussion

The isolation rates observed in this study were lower than those observed in previous studies. *N. gonorrhoeae* was isolated from 50% of cases of male urethritis and 18% of cases of vaginal discharge in Mwanza in 1992. However, the isolation rate dropped to 8% of cases with vaginal discharge in 1994. This may suggest that the culture system for *N. gonorrhoeae* isolation was not working properly. However, Gram stain results correlated well with culture results, suggesting that the procedures were correct and the influence of prior antibiotic use on culture was minimal. Alternatively the trend may suggest a change in pattern of aetiologies of genital discharge syndrome in this population following the introduction of the STD control programme in Mwanza Region. Therefore, there is a need to conduct regular monitoring of the pattern of STD aetiologies for a cost-effective control of STDs using the syndromic approach.

Higher levels of resistance to penicillin in the majority of strains from commercial sex workers suggest that these individuals harbour different strain types compared to those in other patient groups in Mwanza City. Alternatively the majority of these women seek for care at these health facilities after the condition has failed to respond to treatment sought elsewhere. The latter is more likely than the former. If this is the case there is a need to strengthen STD control programmes targeting at commercial sex workers in order to limit the emergency and spread of resistant strains.

The proportion of ß-lactamase producing and tetracycline resistant strains of *N. gonorrhoeae* in this study were similar to that reported in a previous study (*5*). The proportion of isolates resistant to co-trimoxazole was 9% for patients attending various clinics in Mwanza City. This figure is higher than the WHO recommended level of 5% for a drug to continue to be used for syndromic management of STDs. Thus the inclusion of spectinomycin instead of cotrimoxazole in the syndromic management of genital discharge syndrome was a rational policy decision.

All *N. gonorrhoeae* strains isolated from different population groups in this study were sensitive to ciprofloxacin, ceftriaxone, spectinomycin and norfloxacin. These results were similar to those observed in Rwanda, where all the isolates were susceptible to ceftriaxone, ciprofloxacin, kanamycin and spectinomycin (*10*). A small proportion of isolates from refugees in Ngara showed reduced susceptibility to ciprofloxacin and cefuroxime. A similar decreased susceptibility to ciprofloxacin has been reported for gonococcal isolates in Rwanda (*4*). Because resistance to these newer drugs especially ciprofloxacin has been reported elsewhere (*6,11*), and the current use of ciprofloxacin in Tanzania for purposes other than management of STDs, there is a need to carry out regular surveillance of susceptibility of *N. gonorrhoeae* to antimicrobials.

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