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Trachoma and its associate non-chlamydial bacterial conjunctival infection in Sokoto State, Nigeria

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Abstract

Occurrence of non-chlamydial bacterial infection along with trachoma are involved in both the progression of conjunctival scarring and the development of corneal blindness. A total of hundred eye swabs were randomly collected from 100 trachoma patients, 25 from each of four health zone: Dango Shuni, Wurno, Gwadabawa and Yabo in Sokoto State, Nigeria. The patients eye swabs were collected and cultured on blood and chocolate agar. Bacteria found to be associated with the infection are *Staphylococcus aureus*, *Streptococcus pyogenes* and *Pseudomonas aeruginosa*. The susceptibility of isolates was accessed by subjecting them to some commonly used antibiotics; Ampicillin, Tetracycline and Penicillin. These bacteria were relatively susceptible to Tetracycline and Ampicillin and resistant to Penicillin. The study also revealed that the disease had the highest occurrence amongst the females. Association of trachoma with non-chlamydial bacterial conjunctival infection, needs further investigation, especially with regard to progression of scarring and the risk of blindness.

Keywords: Trachoma, Bacterium, children, antibiotics, Sokoto, Nigeria

1. Introduction

Trachoma, also called granular conjunctivitis, Egyptian ophthalmia or blinding trachoma is the most common infectious cause of blindness [1]. It is caused by the bacterium *Chlamydia trachomatis*, responsible for about 1.9 million cases of blindness and 1.4% of the global total of blind individuals [2]. The infection causes repeated episodes of chronic follicular conjunctivitis (clinically active trachoma), drives a progressive inflammatory scarring process. Eventually, the eyelids turn inward (entropion), the lashes come into contact with the eye (trichiasis), and blinding corneal opacification in adults [3].

The bacterium *Chlamydia trachomatis*, that cause the disease can be spread by both direct and indirect contact with an affected person's eye or nose. Indirect contact includes through clothing or flies that have come into contact with an affected person's eye or nose [2]. Many infections are usually needed over a period of years before scarring of the eyelid becomes so great that the eyelashes begin to rub against the eye [2]. Children spread the disease more often than adults. It is also reported that poor sanitation, crowded living conditions, and scarcity of clean water and toilets also increase the transmission [2].

In areas where trachoma is endemic, active (inflammatory) trachoma is common among preschool-aged children, with prevalence rates which can be as high as 60–90% and more commonly affects women than men likely due to their closer contact with children [4]. It commonly occurs in 42 countries of Africa, Central and South America, Asia, Australia and the Middle East, with about 200 million people at risk [2], 8.2 million to have trichiasis, and 40 million to have active disease [5]. It results in 8 billion US dollars of economic losses a year [2]. It belongs to a group of diseases known as neglected tropical diseases [4].

Trachoma is prevalent in Nigeria, and particularly endemic in Adamawa and Borno States, which lie in the WHO-designated "trachoma belt" of Africa [6] and Nassarawa and Plateau in the Central region, and Sokoto, Kebbi and Zamfara in Northern Nigeria [7]. International Trachoma Initiative (ITI) report revealed that about 18 million known Nigeria population are at risk, and people living with trichiasis are nearly 1.3 million, with 79 number of confirmed endemic Local Government Areas and 209 additional Local Government Areas suspected to be endemic [7]. The prevalence of the disease is in the range 0.6%-17.6% for Trichiasis and 5%

-49% for active trachoma across the trachoma belt of Nigeria [8]. Several studies [9-5] have shown that there is occurrence of non-chlamydial bacteria along with trachoma and can frequently be cultured from conjunctival swab samples in individuals with trachoma. These non-chlamydial bacterial infection may be involved in both the progression of conjunctival scarring and the development of corneal blindness. Therefore, the purpose of this study was to discover type and frequency of non-chlamydial bacterial conjunctival infection and the susceptibility of the bacteria to some commonly used antibiotics in four health zones: Wurno, Gwadabawa, Yabo and Dange-Shuni, all in Sokoto State, Nigeria.

2. Materials and Methods

The study was carried out in four health zones in Sokoto State comprising of Yabo, Dange-Shuni, Wurno, & Gwadabawa. Sokoto State is located in the extreme north-west of Nigeria near to the confluence of the Sokoto River and the Rima River. The State is in the dry Sahel, surrounded by sandy savannah and isolated hills. It lies between the latitudes 11°30' N and 14°00' N and longitudes 4°00' E and 6°40' E. Sokoto State covers a total land area of 32,000 sq.km. It is bordered by the Niger Republic in the north, Zamfara State in the east and Kebbi State in the south and west. Sokoto State is mainly populated by Hausa people.

2.1 Sample Collection

A total of 100 eye swabs were collected from 100 infected trachoma patients, 25 from each health zones (Yabo, Dange Shuni, Wurno & Gwadabawa). The specimen were aseptically collected and transported to the laboratory immediately for analysis as described by Ochei and Kohhatkar [13].

2.2 Antibiotic Sensitivity Testing

The inoculum used for sensitivity was prepared from fresh pure cultures of the Bolates (grown overnight on blood agar). Cell suspension of the bacteria to be tested was prepared in sterile saline. The cell suspension was prepared by transforming a portion (about 3-4 calories) of the fresh growth with a swab stick into the suspending medium, taken caution when mixing the cells with the suspending medium to avoid forming bubbles. The suspension was then compared to the 0.5 McFarland turbidity standard by holding the suspension and McFarland standard in front of a light against a white background and comparing the turbidity. Within 15 minutes after adjusting the turbidity of the suspension, the plates were

inoculated using a new sterile swab stick which was submerged in the suspension, lifted out of the broth, and excess fluid removed by pressing and rotating the swab against the wall of the tube. The swab was then used to inoculate the entire surface of the sensitivity agar. The inoculum was allowed to dry for few minutes and the antibiotic discs were then placed on the agar with sterile forceps and tapped gently to ensure adherence to the agar. The following were antibiotics used: ampicillin (10mg), choxacin (1mg), vancomyan (30mg), ciprofloxacin (5mg), tetracycline (10mg) and penicillin (10mg). The plates containing the discs were incubated at 37 °C for 24 hours. After which the plates were then examined for zones of inhibition.

3. Results

Results of the distribution of non-chlamydial bacterial isolates from eye swab samples based on infected patients in each of the study area are presented in table 1. *Staphylococcus aureus* occurred highest with a total frequency of 66(48%) followed by *Streptococcus pyogenes* 52(38%) and *Pseudomonas aeruginosa* with a frequency of 19(14%). The frequency of *Staphylococcus aureus* was 18(27%) in Dange Shuni, 14(21%) in Wurno, 19(29%) in Gwadabawa, and 15(23%) in Yabo. The frequency of *Pseudomonas aeruginosa* was 7(37%) in Dange Shuni, 10(53%) in Wurno, 2(10%) in Yabo and no non-chlamydial bacterial infection was isolated from eye swabs in Gwadabawa. The frequency of *Streptococcus pyogenes* was highest 25(48%) in Yabo, followed by 13 (25%) in Wurno, and 7(13%) in both Dange Shuni and Gwadabawa (table 1).

Trachoma spreads across both females and males in the State, but there was higher incidence in females (92%) than males. In, Wurno, all 25(100)% of those infected were females. There were 23(92)% females out of 25 infected patients in Dange Shuni and Gwadabawa and 21 (84%) in Yabo (table 2). Results in table 3 illustrate the prevalence of the disease among age groups. The disease had its highest (26%) overall prevalence amongst the age group 31-40 yrs, followed by the age group 21-30 years with 21% prevalence, 20% in age group 41-50 years, 13% for both 11-20 and 51-60 years and the lowest in 61-70 years age group with 7% prevalence rate.

Tetracycline and Ampicillin were relatively infective on the organism with the highest zone of inhibition (16 and 17mm). And, all bacteria has shown resistance to Penicillin with 11mm zone of inhibition (table 4).

Table 1: Frequency of occurrence of non-chlamydial bacterium in the various study area

Study area	Non-chlamydial bacterium			Total
	<i>Staphylococcus aureus</i> Frequency (%)	<i>Pseudomonas aeruginosa</i> Frequency (%)	<i>Streptococcus pyogenes</i> Frequency (%)	
Dange Shuni	18(27)	7(37)	7(13)	32(23)
Wurno	14(21)	10(53)	13(25)	37(27)
Gwadabawa	19(29)	-	7(13)	26(19)
Yabo	15(23)	2(10)	25(48)	42(31)
Total	66(48)	19(14)	52(38)	137

Table 2: Distribution of Trachoma according to sex of patients

Study area	Males Frequency (%)	Females Frequency (%)	Total Number of Patients
Dange Shuni	2(8)	23(92)	25
Wurno	0(0)	25(100)	25
Gwadabawa	2(8)	23(92)	25
Yabo	4(16)	21(84)	25
Total	8(8)	92(92)	100

Table 3: Prevalence of Trachoma among age groups in various study area.

Age Group	Dange Shuni	Wurno	Gwadabawa	Yabo	Overall
11 – 20	3	5	3	2	13
21 – 30	4	3	6	8	21
31 – 40	9	6	4	7	26
41 – 50	4	7	5	4	20
51 – 60	3	3	4	3	13
61 – 70	2	1	3	1	7

Table 4: Antibioqram of Isolates Showing Zones of Inhibition in millimetre (mm)

Isolates	Zone of Inhibition (mm)/Antibiotics		
	Ampicillin (10mg)	Tetracycline (30mg)	Penicillin (10mg)
<i>Staphylococcus aureus</i>	16mm	17mm	11mm
<i>Pseudomonas aeruginosa</i>	16mm	17mm	11mm
<i>Streptococcus pyogenes</i>	17mm	17mm	11mm

4. Discussion

Three non-chlamydial bacteria: *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Streptococcus pyogenes* were isolated and found associated with trachoma in Sokoto State. Earlier studies have also explored the relationship between bacterial infection and clinically active trachoma and trichiasis [9-5].

Infection with these bacteria could be as a result of infection with trachoma, thus it may have interfered with the immunologic state of the eye allowing the growth of these bacteria into the conjunctival sac. The climatic environmental condition of the State which is dusty and windy may also allow the growth of these bacteria. Trachoma persists in communities with inadequate access to water and sanitation in hot, dry, dusty climates [14].

The high frequency of occurrence of *Staphylococcus aureus* recorded in all the study area may be as a result of being a normal bacterium of the skin and nasal cavity, become opportunistic pathogens in the eyes, through rubbing of the contaminated hands, clothes or substances on the eyes [15].

The disease spread across both sexes, with highest incidence among females. About 92% of the total population of infected patients examined was females. This finding is similar to the past works by Mc Entegart *et al* [16] and Nurinmen *et al* [17]. Active disease most commonly occurs in children of both sexes and their care givers, usually female due to closer contact with children [14]. This study also revealed the infection had the highest prevalence among the age group of patients within the age limit of 31-40yrs (26%). The age group 31-40 yrs, which constitute active youths, and is a threat to the state economy.

The antibiogram of isolates showed that the isolates were relatively susceptible to the antibiotics used with the exception of Penicillin. This may be due to resistance by a variety of clinical gram-negative organisms, including *Pseudomonas aeruginosa*, which are intrinsically resistant to penicillin. The susceptibility of the organism to Tetracycline is in accordance with the findings of Allen and Samba [18], who reported that antibiotics can be used in the treatment of active trachoma and to reduce the reservoir of infection in a community and that tetracycline ointment applied to the eyes once every day for six weeks will cure effective active trachoma.

5. Conclusion

In conclusion, trachoma is associated with non-chlamydial bacterial conjunctival infection, which needs further investigation, especially with regard to progression of scarring and the risk of blindness. Health education, mass antibiotics distribution, surgeries for people who are at immediate risk of blindness, and improving personal and environmental hygiene remains the preventive and control measures for trachoma and its associated non-chlamydial bacterial infection in the studied health zones.

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