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Original Article

A Survey on Ophthalmia Neonatorum in Benin City, Nigeria (Emphasis on gonococcal ophthalmia)

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ABSTRACT

The purpose of the study was to investigate the incidence of gonococcal ophthalmia neonatorum considering its ability to lead to childhood blindness through corneal ulceration and scarification. Eye swabs were obtained from 330 neonates of 1-5 days in the hospitals of study. Of these, 248 yielded growth and six bacterial genera were identified using standard techniques. *Staphylococcus aureus* was the most prevalent (60.5%) while *Neisseria gonorrhoeae* accounted for 1.7%. Susceptibility patterns of bacterial isolates to four antibiotics were determined using Disk-diffusion tests. *Staphylococcus aureus* and *Neisseria gonorrhoeae* showed 62.5 and 100% susceptibility to Erythromycin while 66.7% of *Escherichia coli* and *Klebsiella* and 62.5% of *Pseudomonas aeruginosa* were susceptible to Gentamicin. The incidence of gonococcal ophthalmia neonatorum for the period of study was 8.9 (cases per 1,000 live births). Prevention is through ocular prophylaxis by the application of either 1% silver nitrate ophthalmic solution or 0.5% erythromycin ointment to the neonates' eyes some hours after birth. This would help to preserve vision and reduce to the barest minimum the incidence of childhood blindness.

INTRODUCTION

Ophthalmia neonatorum (neonatal conjunctivitis) is defined as a conjunctival inflammation that occurs during the first month of life.(1,2) It presents with acute purulent (pus) discharge from the eyes,

usually bilateral and associated with chemosis (edema of the conjunctiva), marked hyperemia and lid edema, which if left untreated can lead to blindness through corneal ulceration and scarification.(3,4)

The neonate's conjunctiva is sterile at birth but soon becomes colonized by various microorganisms that may either be pathogenic or non-pathogenic. The neonate's conjunctiva is prone to infection, not only because there are low levels of antibacterial agents and proteins like lysozyme and immunoglobulin A and G, but because the tear film and flow are only just beginning to develop.(5,6)

In Canada, 71 cases of gonococcal ophthalmia neonatorum were reported within 1989-1998.(7) For Florida in United States of America, 68 cases of gonococcal infections were identified between 1984 and 1988. The rate of clinical gonococcal ophthalmia neonatorum in Florida hospitals from which cases had been reported was 1.7 per 10,000 live births.(8) In another study carried out in Aires, Argentina over a period of four years, neonatal conjunctivitis had an incidence (cases per 10,000 live births) of 39.6 in 1995, 25.3 in 1996, 15.5 in 1997 and 15.2 in 1998.(9)

Ophthalmia neonatorum still leads to blindness in approximately 10,000 babies annually worldwide.(10) In the study carried out in Kenya, four perinatal factors namely maternal vaginitis, presence of meconium at birth, birth in a non-sterile environment and postnatal development of

endometritis were identified.(10) In another study, premature rupture of membranes, documented or suspected sexually transmitted disease and local eye injury during delivery were identified as risk factors for ophthalmia neonatorum to occur.(11)

Most ophthalmic infections in the neonatal period are acquired during vaginal delivery and reflect the sexually transmitted diseases prevalent in the community.(2) The transmission rate of gonorrhoea from an infected mother to her newborn is 30 – 50%.(2,12,13) Vertical transmission may play an important role in neonatal conjunctivitis, as 67% of bacteria from the infected neonates were similar to those detected in lower genital tract and placentae of mothers, as shown in the study conducted in Beijing by Gao.(14)

Numerous studies have shown that *Chlamydia trachomatis*, *Staphylococcus aureus*, *Neisseria gonorrhoeae*, *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Escherichia coli*, *Klebsiella* sp, *Pseudomonas aeruginosa* as well as chemical agents have been identified as causative agents of ophthalmia neonatorum.(11,15,17) The most important bacterium by its potential to damage vision was *Neisseria gonorrhoeae*.(11) *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Chlamydia trachomatis* have at one point or the other been identified as the commonest causative agents.(17-21)

Neisseria gonorrhoeae has a strong affinity for columnar and transitional epithelium and having attached to the mucosal cells begins to produce substances like proteases, elastases that play an important role in its pathogenicity. The end result is the development of ophthalmia neonatorum when the neonate is delivered through the passage where the organism is already established.(7,15) Corneal ulceration, perforation, scarification and consequent blindness result from untreated or poorly treated gonococcal ophthalmia neonatorum.(2,12,13,22)

Clinical presentations of ophthalmia neonatorum are not diagnostic of the cause, and microbiologic work-up with cytology, cultures and microbial sensitivities is mandatory. The selection of specific antimicrobial therapy is based on the findings of laboratory.(23)

A single low dose of ceftriaxone (62.5mg for babies and 125mg for mothers) has been shown to eradicate *Neisseria gonorrhoeae* from all babies' eyes with no residual damage, as well as from the mothers' cervixes.(24) Cefixime, ceftriaxone, third generation cephalosporins and the fluoroquinolones are generally effective against *Neisseria gonorrhoeae*.(7)

The ideal prophylactic agent would be both non-toxic and highly effective in preventing gonococcal,

chlamydial and nongonococcal and nonchlamydial ophthalmia neonatorum. Since gonococcal ophthalmia poses the greatest threat to a child's vision, the principal goal of ocular prophylaxis is the prevention of gonococcal infections.(15) Application of topical 1% silver nitrate to the eyes of newborns has helped in the prevention of gonorrheal ophthalmia.(25-28) Erythromycin and tetracycline are other prophylactic agents that can be utilized in newborns to prevent the disease.(13,27,29,30) All three agents have been found to be effective against the disease when used separately.(15,27,31) The effectiveness and safety of povidone-iodine were studied along side with 1% silver nitrate and 0.5% erythromycin, and was found to be more effective.(10,29,32,33) Management of ophthalmia neonatorum should be syndromic and systemic. Contact tracing is an integral part of the management.(34)

METHODS

Samples were collected by swabbing the lower conjunctival surfaces (with sterile swabs) of healthy neonates within 1-5 days at the special baby units of University of Benin Teaching Hospital and Central Hospital in Benin City, Nigeria. The swabs in the containers were labeled for the required tests and then transported to the Microbiology laboratories of the hospitals within two hours of collection. On arrival at the laboratories, the specimens were registered and then cultured onto pre-labeled oven-dried agar plates (Chocolate, Nutrient and Blood agar) at 37°C for 24 hours. The chocolate plates were incubated under microaerophilic conditions or anaerobic environment using CO₂ jar. After the overnight incubation, the culture plates with growth were streaked and sub-cultured for another 24 hours at 37°C. The agar plates without growth were further incubated for 24 hours at 37°C after which those with growth were sub-cultured for purification. Using standard techniques, which included cultural, colonial morphology and biochemical characteristics of these isolates on the media, identified the isolates obtained. The antibiotic susceptibility patterns were determined by using Disk-diffusion tests.

RESULTS

A total of 220 eye swabs were collected from neonates (with and without discharges) in University of Benin Teaching Hospital. 195 samples yielded growth of which 175 were from discharging and 20 from non-discharging eyes. For Central hospital, a total of 110 eyes swabs were obtained from neonates with and without discharges. Of this number, 88 yielded growth while 22 yielded no growth; 73 were from discharging eyes and 15 were from non-discharging eyes. The identification of the isolates is presented in Table 1. Tables 2 and 3 show the number of isolates obtained from diseased and healthy eyes of neonates from the hospitals.

Table 1: Identification of bacterial isolates

+ POSITIVE TEST; - NEGATIVE TEST; A = Acid production; gas may or may not be produced; NA = No acid production

Morphology	Gram stain	Lactose	Glucose	Mannitol	Catalase	Coagulase	Mannose	Methyl red	Voges Proskauer	Motility	Citrate	Indole	Oxidase	Urease	Probable identity of isolates
Rods in short chains	-	A	A	A	+	-	A	+	-	+	-	+	-	-	<i>Escherichia coli</i>
Cocci in pairs	-	NA	A	NA	-	-	NA	-	-	-	-	-	+	-	<i>Neisseria gonorrhoeae</i>
Rods in long chains and clusters	-	NA	A	NA	+	-	NA	+	+	-	+	-	+	+	<i>Pseudomonas aeruginosa</i>
Short rods in pairs	-	A	A	A	+	-	NA	-	-	-	+	-	-	+	<i>Klebsiella</i> sp
Cocci in clusters	+	NA	A	NA	+	+	NA	-	-	-	-	-	-	-	<i>Staphylococcus aureus</i>
Cocci in chains	+	NA	NA	NA	-	-	NA	-	-	-	-	-	-	-	<i>Streptococcus</i> sp

Table 2: Number of bacterial isolates obtained from diseased and healthy eyes (University of Benin Teaching Hospital)

Organisms	Number of isolates from diseased eyes n= 175(%)	Number of isolates from healthy eyes n= 20(%)
<i>Staphylococcus aureus</i>	104 (59.4)	11 (55)
<i>Streptococcus viridans</i>	19 (10.9)	4 (20)
<i>Escherichia coli</i>	27 (15.4)	3 (15)
<i>Klebsiella</i> sp	6 (3.4)	2 (10)
<i>Pseudomonas aeruginosa</i>	16 (9.1)	0
<i>Neisseria gonorrhoeae</i>	3 (1.7)	0

Table 3: Number of bacterial isolates obtained from diseased and healthy eyes (Central Hospital)

Microorganisms	Number of isolates from diseased eyes. n= 73 (%)	Number of isolates from healthy eyes. n= 15 (%)
<i>Staphylococcus aureus</i>	46 (63)	7 (46.7)
<i>Streptococcus</i> sp	19 (26)	4 (26.7)
<i>Escherichia coli</i>	4 (5.5)	3 (20)
<i>Pseudomonas aeruginosa</i>	3 (4.1)	1 (6.7)
<i>Neisseria gonorrhoeae</i>	1 (1.4)	0

The difference between the number of isolates from diseased and healthy eyes was statistically significant by Wilcoxon ($p=0.02$) for samples from University of Benin Teaching Hospital. However, the difference in the number of isolates from diseased and healthy eyes of neonates from Central Hospital was not statistically significant ($p=0.31$). *Escherichia coli* and *Klebsiella* sp showed 66.7% and *Pseudomonas aeruginosa* 62.5% susceptibility to gentamicin. In addition, *Staphylococcus aureus* and *Neisseria gonorrhoeae* showed 62.5 and 100% susceptibility to erythromycin. From this study, the organisms implicated in ophthalmia neonatorum in order of decreasing frequency are *Staphylococcus aureus*, *Streptococcus* sp, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella* sp and *Neisseria gonorrhoeae* (Table 4). The incidence of gonococcal ophthalmia neonatorum for the study period was 8.9 (Table 5).

Table 4: Frequency of organisms implicated in ophthalmia neonatorum in the hospitals of study.

Organisms	Total number of isolates from diseased eyes n= 248	%
<i>Staphylococcus aureus</i>	150	60.5
<i>Streptococcus</i> sp	38	15.3
<i>Escherichia coli</i>	31	12.5
<i>Pseudomonas aeruginosa</i>	19	7.7
<i>Klebsiella</i> sp	6	2.4
<i>Neisseria gonorrhoeae</i>	4	1.6

Table 5: Incidence of gonococcal ophthalmia neonatorum in the hospitals of study for January – December, 2001

Hospitals	Total number of bacterial isolates from diseased eyes	Total number of <i>Neisseria gonorrhoeae</i>	Incidence of gonococcal ophthalmia neonatorum(per 1,000 live births)	Total live births
University of Benin Teaching Hospital	175	3	10.6	283
Central Hospital	73	1	5.9	169
University of Benin Teaching hospital and Central hospital	248	4	8.9	452

DISCUSSION

This study shows that several organisms were isolated from the eye swabs of neonates with conjunctivitis. These same organisms have been isolated in previous studies.(11,15,17) *Staphylococcus aureus* predominated as a cause of ophthalmia neonatorum. *Streptococcus* sp, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella* sp and *Neisseria gonorrhoeae* followed this. *Chlamydia trachomatis* was not isolated. This finding is consistent with the results of other investigators (17,18) who reported that *Staphylococcus aureus* was the commonest causative agent of ophthalmia neonatorum in their studies. In one of these studies, *Staphylococcus aureus* was followed by *Escherichia coli*, *Pseudomonas aeruginosa*, while *Chlamydia trachomatis* and *Neisseria gonorrhoeae* were responsible for less than 5% of all cases. This study however differed from that of Yetman and Coody (11) who found *Chlamydia trachomatis* most prevalent. In other studies, *Haemophilus influenzae*, *Streptococcus pneumoniae* and *Pseudomonas aeruginosa* were at one point or the other found as the prevalent bacterial pathogens in ophthalmia neonatorum.(19-21)

The difference in the number of bacterial isolates from neonates with and without the disease in

University of Benin Teaching hospital was statistically significant ($p=0.02$). The larger number of isolates from neonates with the disease shows the degree of pathogenicity of the organisms implicated in ophthalmia neonatorum. In the past, the disease was thought to be caused by either *Neisseria gonorrhoeae* or *Chlamydia trachomatis*.(35)

In all cases *Neisseria gonorrhoeae* was isolated only from neonates with conjunctivitis in both hospitals. The incidence of gonococcal ophthalmia neonatorum in Benin City within the period of study was 8.9 per 1,000 live births. This finding is close to the 15.5 in 1997 and 15.2 in 1998 for Aires, Argentina by De Bartolomeo et al.(9) An incidence of 1.7 per 10,000 live births was reported in Florida, United States of America (8), which is very much lower than the finding of this study. The incidence of gonococcal ophthalmia neonatorum appears high when compared to those of advanced nations like United States of America and Canada, is still within acceptable limits taking into cognizance the limited resources available for health care delivery system in developing countries.

The campaign against childhood blindness is gradually gaining grounds. In these days where

there is an upsurge of HIV/AIDS, many young adults who used to indulge in indiscriminate sex have refrained themselves with a good percentage using precautionary measures like keeping a single partner and the use of condoms. This has also helped in reducing the transmission of sexually transmitted diseases hence the incidence of gonococcal ophthalmia neonatorum is not alarming. Also, in the hospitals of study, preventive measures are taken as a drop of 1% silver nitrate solution is applied to each eye of the neonate some hours after birth.

Since gonococcal ophthalmia neonatorum poses the greatest threat to a child's vision, it is generally believed that the principal goal of ocular prophylaxis should be the prevention of the disease.(15,36) The susceptibility of the organisms implicated to four antibiotics was carried out. *Staphylococcus aureus* and *Neisseria gonorrhoeae* showed susceptibility of 62.5 and 100% to erythromycin while 66.7% of *Escherichia coli* and *Klebsiella* sp and 62.5% of *Pseudomonas aeruginosa* were susceptible to gentamicin. Several studies have shown that erythromycin, tetracycline and silver nitrate are effective in preventing gonococcal ophthalmia.(13,27,29,30) This study also shows that erythromycin would help in the prevention of the disease when applied to the neonates' eyes some hours after birth.

The W.H.O. Vision 2020-"The Right to sight, Global initiative for the elimination of avoidable blindness" is highly committed to the control of blindness in children. It has been found that ophthalmia neonatorum among others are the major causes of blindness in low-income countries in Africa and other continents.(37) In about 50% of children who are blind today, the underlying cause could have been prevented, or the eye condition treated to preserve vision or restore sight.(37)

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