

Neonatal conjunctivitis: aetiology, diagnosis and treatment

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Summary

In a case control study of 426 unselected deliveries at the De Soysa Hospital for Women, 85 (20%) infants had conjunctivitis. *Chlamydia* species (spp) and viruses were not detected. *Staphylococcus aureus* was the commonest pathogen isolated and was detected in 47% of cases. *Klebsiella* spp was isolated from 27%. *Pseudomonas* spp, *Streptococcus viridana* and coliform isolation rates were not significantly different to that of controls, although significantly higher counts of bacteria were found in the cases. Therefore it would be more useful to the clinician if the laboratory report indicated the severity of infection.

Only 51% of the isolates were sensitive to the conventionally used antibiotic, chloramphenicol. Treatment with saline washes appear to be sufficient in the first few days of the illness as there is spontaneous resolution of clinical appearance within 48-72 hr in a majority of patients.

Introduction

Conjunctivitis is frequently seen in newborn babies. The neonatal conjunctiva is prone to infection not only because there are low levels of antibacterial substances in tears, but also because the tear flow and film are only beginning to develop⁽¹⁾. *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Haemophilus* spp and *Neisseria gonorrhoeae* are established pathogens. However, *Pseudomonas* spp. (2), *Klebsiella* spp, *Escherichia coli* (3), *Streptococcus viridans*, *Herpes simplex* virus type 1 and II (4), adenovirus type 8 (5) and *Mycoplasma* spp (6) have also been isolated from cases of ophthalmia neonatorum

(ON). *Chlamydia trachomatis* has also been recognized as an important cause of neonatal conjunctivitis (7). Chlamydial ON is usually contracted in the intrapartum period but develops after the baby has left the hospital. It does not respond to the commonly used topical antibiotics.

This prospective study was undertaken to establish the incidence, aetiology, natural history and treatment of ON.

Materials and Methods

A case control study was done. The study population consisted of 426 neonates from consecutive deliveries in the University Unit of the De Soysa Hospital for Women (DSHW) between May to August 1987. The newborns were 1-7 days old during the time of examination. ON was diagnosed by the presence of an overt ocular discharge and/or conjunctival hyperaemia.

The eye discharge was collected from the inferior palpebral conjunctival surface on three cotton wool swabs. One swab was used for making smears on 2 glass slides for Gram and Giemsa staining to examine for pus cells and chlamydial inclusion bodies respectively. The second swab was swirled in sucrose phosphate transport medium and placed in virus transport medium for *Chlamydia* and virus isolation respectively. The material from the third swab was immediately inoculated at the bed-side on to a blood agar plate followed by plating on MacConkey and chocolate agar plates for isolation of bacteria. The blood and chocolate agar plates were incubated at 37 C in 5% CO₂ for 48 hrs, and MacConkey plates at 37 C aerobically.

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Colony counts were done using the blood agar plate. To facilitate counting of colonies on blood agar the swab was rolled across the same diameter of the plate twice and streaking was carried out perpendicular to the inoculation line with a bacteriological loop. The bacteria were identified using standard laboratory techniques (8). Antibiotic sensitivity testing was performed using Stokes disk diffusion method (9).

In the Gram stained smear, pus cells in 100 fields were counted to obtain the average numbers of pus cells per field as viewed by the oil immersion objective (H1000; x 1000).

The sample collected on to sucrose phosphate medium was inoculated on to cycloheximide treated McCoy cells for the isolation of *Chlamydia trachomatis*. After 48 hrs. the cells were stained using Giemsa stain and examined under dark ground microscopy for inclusion bodies.

The samples collected on to the virus transport medium was inoculated on to primary human embryonic kidney cell and Vero cell lines for the isolation of adeno and *Herpes simplex* viruses respectively and observed for cytopathic effects after 7 days.

A control population of 40 neonates without conjunctivitis who were matched for age at the onset of symptoms and type of delivery were similarly examined.

Treatment was carried out in the usual manner, ie. sterile saline washes in mild cases and chloramphenicol eye drops 6 hourly in severe cases, as judged by the clinical signs. One month after discharge from hospital a questionnaire was sent to all mothers of babies with ON to determine the type and response to treatment.

Results

During the period of study there were 426 deliveries and 85 babies had conjunctivitis resulting in a 20% incidence. Table 1 shows the groups of organisms isolated in both groups (cases and controls). Viruses and *Chlamydia* spp were not detected. Thus the

aetiology was exclusively bacterial. 35% (14/40) of the control group did not show any bacterial growth in contrast to 2.3% (2/85) in the group with conjunctivitis.

Table 1. Incidence of groups of organisms isolated from cases and controls

Group of organisms	Cases (%) n=85	Controls (%) n=40
Pathogenic bacteria	77 (90.5)	18 (45)*
Nonpathogenic bacteria	6 (7.0)	8 (20)
Adeno/ <i>Herpes Simplex</i> virus	0	0
<i>Chlamydia</i>	0	0
No microorganisms	2 (2.3)	14 (35)*

* $P < 0.001$, Chi²

Table 2 lists the main species of bacteria isolated from the study group. From each patient only the predominant bacterial species isolated were considered in the analysis of results. *Staphylococcus epidermidis* and diphtheroids which are skin commensals were found in both test and control groups. The bacteria conventionally accepted as pathogens were found more often among cases than among controls. However among these only *Staph aureus* and *Klebsiella* spp were isolated in a significantly higher number of cases than from controls. Two babies with symptoms had mixed infections with *Staph aureus* and *Klebsiella* species. *S viridans*, *Pseudomonas* spp and coliforms which are often accepted as aetiological agents of neonatal conjunctivitis were not significantly different in the two groups. However, the colony counts of these bacteria were found to be significantly higher in the test group than among the controls (Table 3). Although *Branhamella catarrhalis* has been reported from neonates with conjunctivitis in other studies (10), it was not isolated in our series.

Table 2. Incidence of the predominant bacterial species isolated from the study group

Bacteria isolated	Cases (%) n=85	Controls (%) n=40
<i>S. aureus</i>	40 (47)	10 (32.5)*
<i>Klebsiella</i> spp	23 (27)	2 (5)+
<i>S. viridans</i>	5 (5.8)	2 (5)
<i>Pseudomonas</i> spp	4 (4.7)	1 (2.5)
Coliforms	3 (3.5)	-
<i>S. epidermidis</i>	4 (4.7)	7 (17.5)
Diphtheroids	2 (2.3)	1 (2.5)

* p < 0.5, Chi²

+ p < 0.01, Chi²

80% of babies with ON showed pus cells on Gram stained smears compared to 20% in the control group. The number of pus cells/high

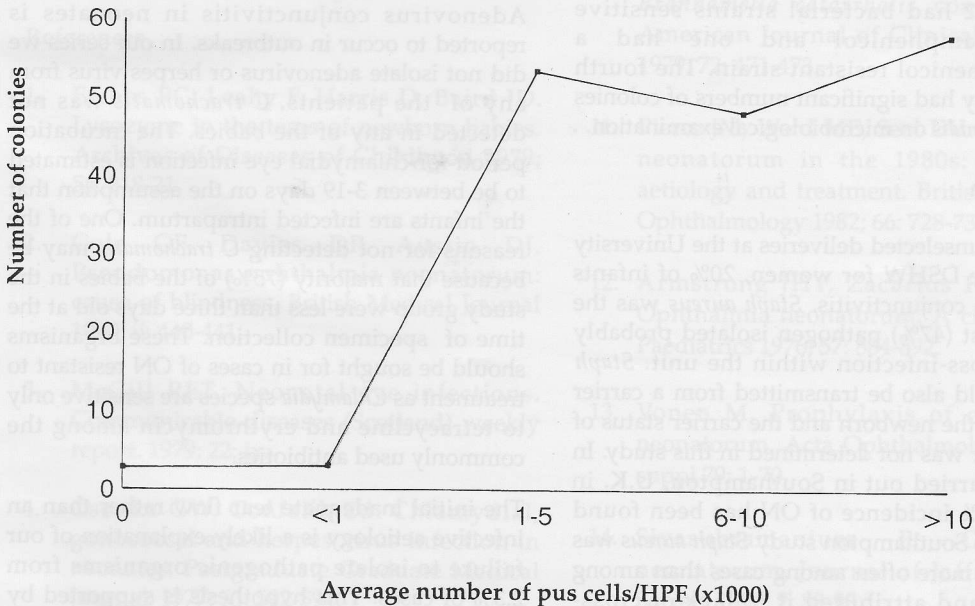
Table 3. Average number of colonies of pathogenic bacteria isolated from cases and controls

	Cases (%) n=75	Controls (%) n=15
<i>S. aureus</i>	56.2	5.1
<i>Klebsiella</i> spp	39.5	2.5
<i>S. viridans</i>	56.4	6.0
<i>Pseudomonas</i> spp	49.2	2.0
<i>Chlamydia</i>	0	0

* P < 0.001, Chi²

power field (1000X) correlated well with the numbers of organisms found in each patient (Figure 1).

Fig. 1 Average number of pus cells in Gram stain vs number of colonies in the study group



41 out of the 85 parents of the babies who had ON responded to the questionnaire. Out of the 41, 27(66.8%) had received chloramphenicol eye drops. The remaining patients had received sterile saline washes. 4 out of the 41 (9.7%) continued to have the eye discharge on and off even after one month of local antibiotic treatment, but others were rid of symptoms by two weeks irrespective of whether they received antibiotics or saline washes.

49% of isolates showed chloramphenicol resistance on the antibiotic sensitivity test. Out of the 37 babies, who recovered completely 18 had chloramphenicol resistant strains and 11 out of the 18 had used chloramphenicol eye drops for an average period of 5 days (range being two days to two weeks). The remaining 7 babies with chloramphenicol resistant strains had no antibiotics yet both groups recovered irrespective of treatment.

Among the 19 babies who harboured chloramphenicol sensitive strains only 9 had received chloramphenicol eye drops. The 4 babies who continued to have an eye discharge for over one month in spite of antibiotic treatment were not available for follow up by microbiological examination. Among these 4 babies 2 had bacterial strains sensitive to chloramphenicol and one had a chloramphenicol resistant strain. The fourth patient only had significant numbers of colonies of *S epidermidis* on microbiological examination.

Discussion

From 426 unselected deliveries at the University unit of the DSHW for women, 20% of infants developed conjunctivitis. *Staph aureus* was the commonest (47%) pathogen isolated probably due to cross-infection within the unit. *Staph aureus* could also be transmitted from a carrier mother to the newborn and the carrier status of the mother was not determined in this study. In a study carried out in Southampton, U.K. in 1982 a 12% incidence of ON has been found (11). In the Southampton study *Staph aureus* was not found more often among cases than among controls and attributed it to lack of cross-

infection within the unit. Yet other workers have found it to be an important pathogen in ON (12, 13). A study carried out in the De Soysa Eye Institute, Kandy in 1940's found *Staphylococcus* 26%, *Gonococcus* 24%, *H ducreyi* 10%, *Pneumococcus* 2%, *Morax-Axenfeld* 10% and undetermined 34%, in patients presenting with conjunctivitis and is the only study previously published from Sri Lanka (14). The results can not be compared with the present study as the study populations are different.

Klebsiella spp was isolated from 27% of neonates with symptoms. This was not found to be a significant pathogen in other studies. The average numbers of *Pseudomonas* spp, *S viridans* and coliforms per specimen were significantly higher in the group with symptoms although the isolation rate of these organisms were not significantly different to those of the control group. Therefore it is more useful to report as mild, moderate or heavy growth to indicate the severity of infection. The more accurate methods of determining the number of bacteria in specimens were not used in the study due to technical difficulties. Ideally a fixed aliquot of conjunctival fluid or standard loop method should have been used for determining colony counts.

Adenovirus conjunctivitis in neonates is reported to occur in outbreaks. In our series we did not isolate adenovirus or herpes virus from any of the patients. *C trachomatis* was not detected in any of the babies. The incubation period for chlamydial eye infection is estimated to be between 3-19 days on the assumption that the infants are infected intrapartum. One of the reasons for not detecting *C trachomatis* may be because that majority (75%) of the babies in the study group were less than three days old at the time of specimen collection. These organisms should be sought for in cases of ON resistant to treatment as *Chlamydia* species are sensitive only to tetracycline and erythromycin among the commonly used antibiotics.

The initial inadequate tear flow rather than an infective aetiology is a likely explanation of our failure to isolate pathogenic organisms from 2.3% of cases. This hypothesis is supported by

the following observations. Firstly the natural history of ON is for a tendency towards spontaneous resolution within 48-72 hrs, without any specific treatment. In our study among babies who received topical chloramphenicol treatment only 51% of the isolates were sensitive to chloramphenicol. Yet both groups recovered completely, irrespective of whether they had either chloramphenicol sensitive strains or not. In babies from whom chloramphenicol sensitive strains were isolated recovery rates were similar, irrespective of whether they received sterile saline washes or chloramphenicol eye drops. Therefore it is suggested that treatment with sterile saline washes may suffice for the first 72 hrs. However, if no response is observed at 72 hrs. topical chloramphenicol should be used. If the conjunctivitis persists after two weeks the patient should be investigated for chlamydial infection or an anatomical abnormality.

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