Risk of developing neonatal conjunctivitis in newborns of mothers with prolonged labour

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ABSTRACT

Objective: **To determine whether prolonged labour increased the rate of exposure of the newborn eyes to maternal vaginal flora, and whether this exposure led to higher risk of developing neonatal conjunctivitis.**

Study design: cohort study

Settings: **Kenyatta National hospital and Pumwani Maternity Hospital in Kenya between August 2000 and March 2001.**

Subjects: Fifty four cases of prolonged labour (PL) and 55 cases of controls were studied. Conjunctival swabs were taken from all the newborns and high vaginal swabs taken from every second mother. A case pair consisted of such a pair where samples were taken from both the mother and her baby. 23 case pairs of PL and 19 of controls were studied. This was done on average 24hrs after delivery.

Results: **Conjunctival swabs were positive in 63% of the prolonged labour (PL) group compared to 51% of the control group (odds ratio 1.9; p-value 0.09). The rate of transmission of vaginal flora to the eyes of the newborns was 57% in the PL group compared to 40% in the controls (odds ratio 1.95; p value 0.27). The longer, from birth, it took before taking the conjunctival swabs from the baby, the higher was the likelihood of obtaining a positive culture (p-value 0.017 MW test). The longer the duration of labour in the PL group, the higher the rate of development of conjunctivitis (p-value 0.029 MW test). *Staphylococcal aureus, Staphylococcal epidermidis and E.coli* were the three most common organisms isolated in both groups.**

Conclusion: **Prolonged labour increased the rate of transmission of maternal vaginal flora to the eyes of the newborns and to subsequent development of neonatal conjunctivitis.**

BACKGROUND

The healthy human fetus has no resident microbial populations up to the time of its birth. It acquires on its surface or swallows or inhales an assortment of micro-organisms from the mother's birth canal and these are soon reinforced by contributions from various human inanimate (and possibly also animal) sources in the newborn infants immediate environment. These organisms which find themselves in suitable environments, whether on the outer or inner body surfaces, begin to multiply and to enter into complex competitive relationships with other potential colonizers. Within hours of birth, the infant has begun to acquire a resident microbial population. Populations are different on or in different body surfaces depending on factors that enhance the organisms to thrive. These organisms, which form a normal flora in their particular environments e.g. the conjunctiva, are normally harmless, but can occasionally cause disease. The pattern of these microorganisms' changes over the years, and an organism once known to be harmless becomes virulent. Spread from one baby to another is a constant risk, and an organism that may cause mild symptoms in one baby may cause a more serious infection in another.[1]

Mode of Transmission

Most studies point out to contamination of the eyes in the birth canal during delivery as the most common mode of transmission.[2] Other modes that have been implicated include, delivery in non-sterile environment, where non-sexually transmitted organisms have been seen to predominate in the neonatal units and hospital born babies. [3,4] Flies and formites have also been implicated in transmission of organism to the eyes of the exposed in trachoma endemic areas.[5] A nosocomial infection, mostly with Pseudomonas has also been shown to cause neonatal conjunctivitis.[5, 6] Factors that cause or prolong exposure of the neonatal eyes to the flora of material birth canal, have been shown to put the newborn at

higher risk of developing O.N. These factors include premature rupture of membranes (PROM) and prolonged labour.[7]

Prolonged Labour

Prolonged labour is defined as labour that takes more that 12 hours. It has also been defined as labour that needs to be augmented with Oxytocin due to delay in the first stage. The longer the labour takes the longer the foetus is exposed to maternal vaginal flora and, the more frequent the vaginal examinations done, that contaminate the foetal part with microbial agents. Frequent digital examinations may be related to increase foetal bruising of facial structures and hence increased risk of infection. In those augmented during labour, sepsis has been demonstrated to have the highest indication of neonatal morbidity.[8] Causes of protracted active phase of labour include cephalo-pelvic disproportion, occipital posterior and transverse positions, amniotomy performed before or at onset of labour, excessive sedation or anaesthesia administered in latent phase or early in active phase, and incoordinate uterine contractions.[9]

The organisms responsible for neonatal infections via ascending the birth canal, especially after Premature Rupture of Membranes include: Group B *Streptococcus, E- coli, Pseudomonas auroginasa, Listeria monocytogenes, Mycoplasma horminis, Neisseria gonorrhea, Hepatitis B virus, Candida albicans, and Chlamydia trachomatis*.[10]
Within the first few days of life, the baby becomes colonized by bacteria which are normally harmless, but which can occasionally cause disease. The pattern of pathogenesis of organisms is known to change over the years. Spread from one baby to another is a constant risk, for example, mild Staphylococcal 'sticky eye' which in itself is trivial, can be a source of much more serious infections like staphylococcal pneumonia, bullous impetigo etc, in other infants soon or at a later stage.

Neonatal Conjunctivitis

A Summary of clinical presentation [2,11]

ONSET	PRESENTATION	AETIOLOGY
Within 24hrs	Mild lid oedema, watery discharge	Silver nitrate
2 to 4 days	Severe lid swelling, purulent discharge	N. gonorrhea
4 to 10 days	Variable severity of lid swelling, serous or purulent discharge	Chlamydia
4 to 7 days	Purulent discharge	Other bacteria (staphylococcal, streptococcal)
6 days to 2 weeks	Often unilateral serous discharge with keratitis	Herpes simplex

Prophylaxis for Neonatal Conjunctivitis

Prophylaxis for neonatal conjunctivitis has over the years received increasing attention due to its effectiveness in reducing O.N. Controversy may range as to who, when, how and what, to give but little doubt exists as to the usefulness of prophylaxis. It is an important public health measure to prevent sexually transmitted infections, and their consequences, on pregnant women and the neonates. Intervention can be instituted in early or late pregnancy(especially in those complicated by PROM), during labour or after delivery (depending largely on the high risk events that may occur during labour, like prolonged labour) in the mother or in the neonate.[2] Different preventive regimens can be applied; to all pregnant women, or all infants at the time of delivery or only high risk groups like PROM, Prolonged Labour, mothers with vaginitis, birth in non-sterile environment, presence of meconium at birth, etc.[4]

METHODS

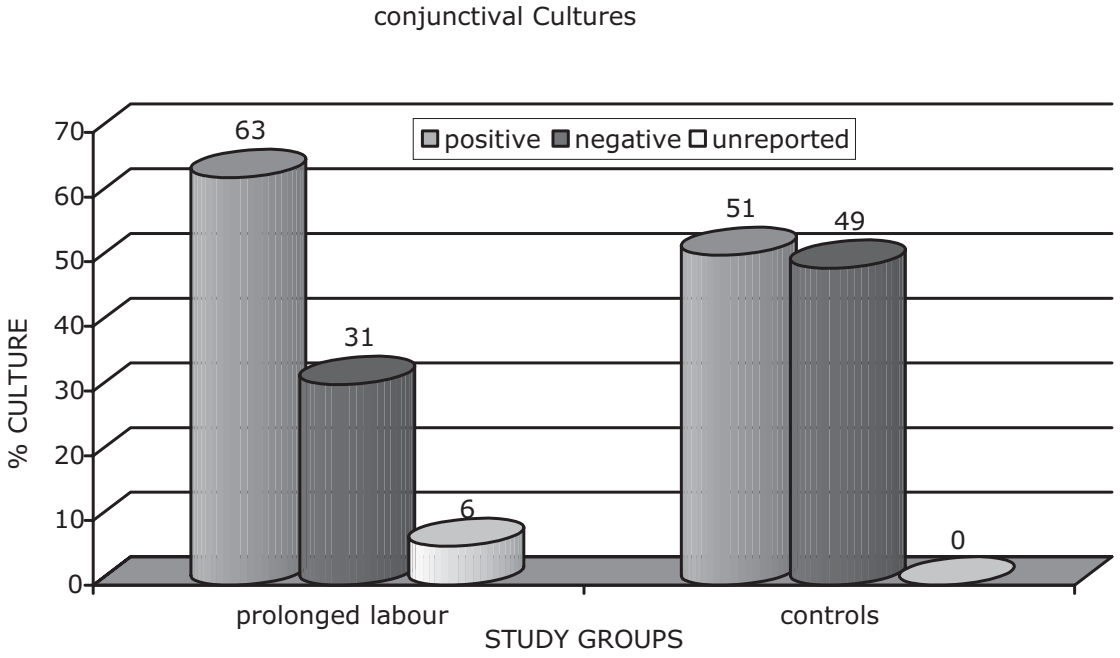
This prospective, analytical case control study was carried out between August 2000 and March 2001, in Kenyatta National hospital and Pumwani Maternity Hospital in Kenya. The protocol was reviewed and approved by the respective hospitals' ethical and research committees. 54 cases of prolonged labour (PL) and 55 cases of controls were studied. Conjunctival swabs were taken from all the newborns and high vaginal swabs taken from every second mother. A case pair consisted of such a pair where samples were taken from both the mother and her baby. 23 case pairs of PL and 19 of controls were studied. This

was done on average 24hrs after delivery. Sequential non-probability sampling method was applied. The diagnosis of prolonged labour was as made by the mid-wife and / or obstetrician. Controls were mother and babies of mothers with uncomplicated peri-natal period and delivery. Consents were obtained from all the mothers included in the study. Conjunctival swabs were taken from all newborns included in the study. High vaginal swabs were taken from every second mother at the same sitting as the conjunctival swabs. This was done on average 24hrs after delivery. The specimens were then subjected to microscopy, culture and sensitivity studies. The neonates were seen in the maternal and child health clinic, after two weeks, to examine for signs of conjunctivitis. Instructions were given to present earlier in case signs of eye disease appeared. Data input and analysis was carried out using SPSS for windows and Microsoft excel and standard procedures employed for data validation

RESULTS

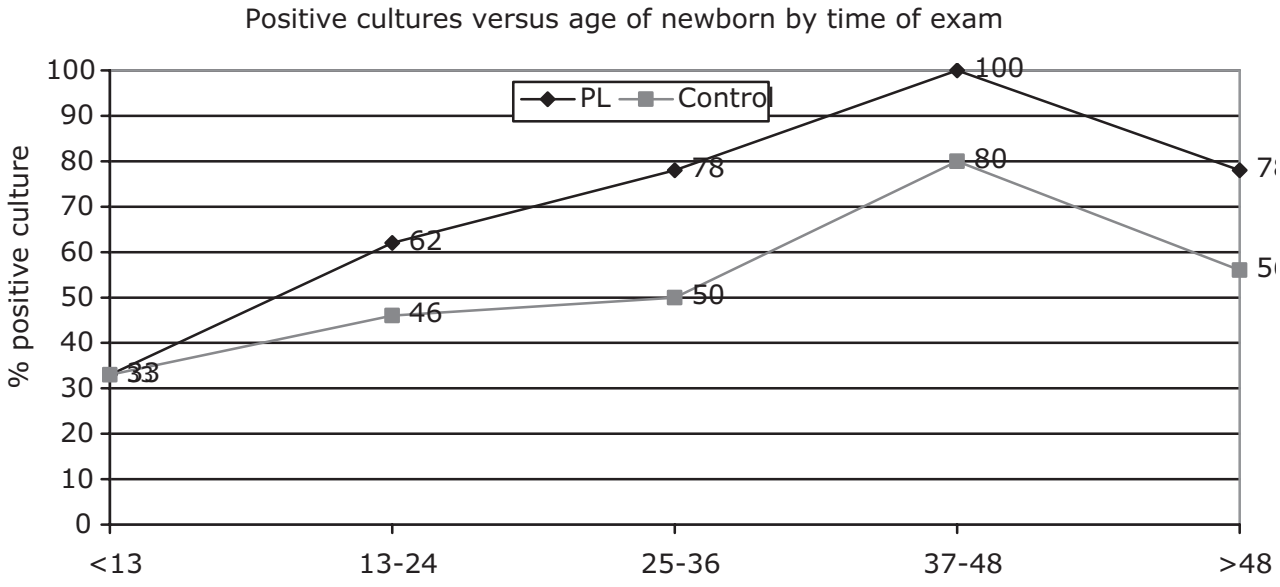
There were 54 babies in the PL group and 55 in the control studied. The average maternal age was 23 years for both groups with slightly younger mothers seen in the PL group (mode 18yrs) compared to 23yrs in the control group. Conjunctival swabs were performed, on average, 24hrs after delivery for both groups. There were no statistical differences between the groups, in as far as mothers who received antibiotics two weeks before and during delivery, mothers who had antenatal vaginal discharge, mean parity for the mothers, premature babies (below 37 wks), mode of delivery, and use of ocular medications before the swabs were taken.

Figure 1



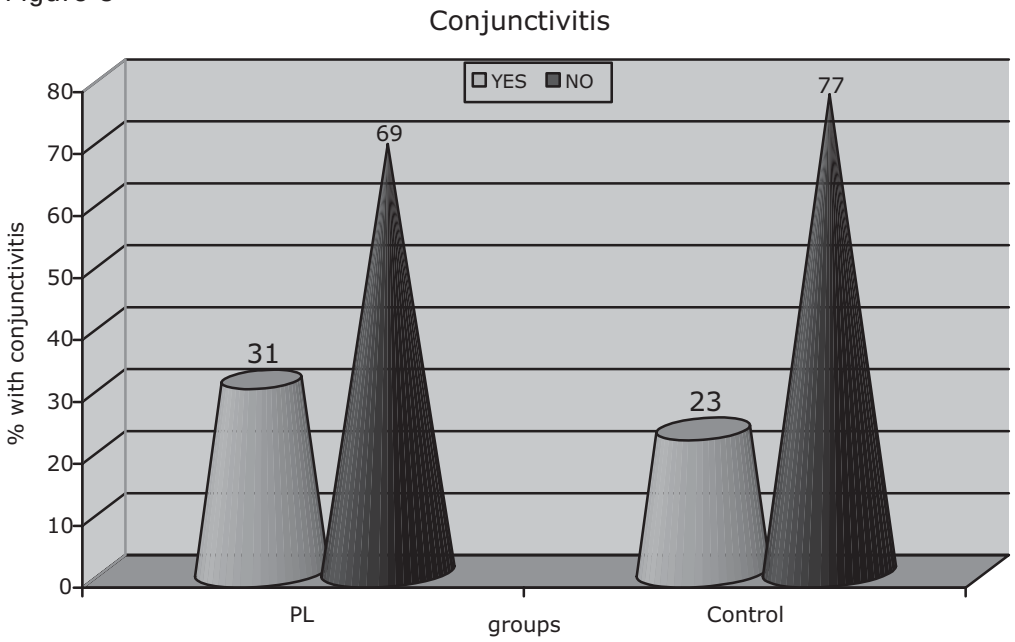
Proportion with positive cultures in PL was 63% compared to 51% in controls (odds ratio 1.9 p-value = 0.09)

Figure 2



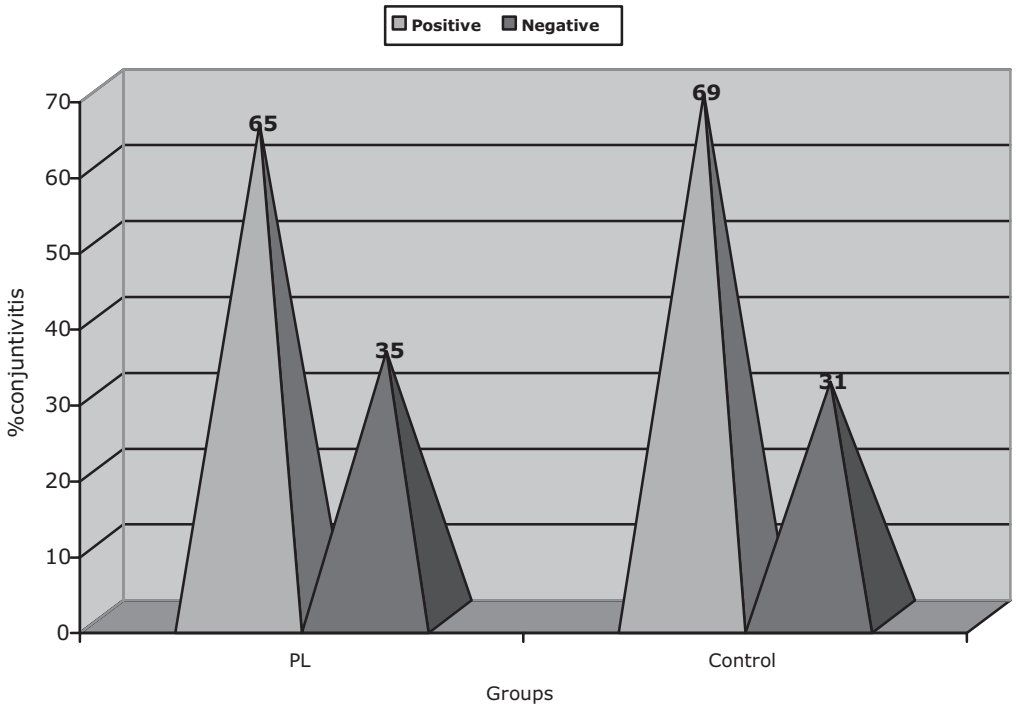
The longer the delay, from time of birth, of taking the conjunctiva swabs, the higher the rate of obtaining positive cultures, in Prolonged labour (p = 0.017)

Figure 3



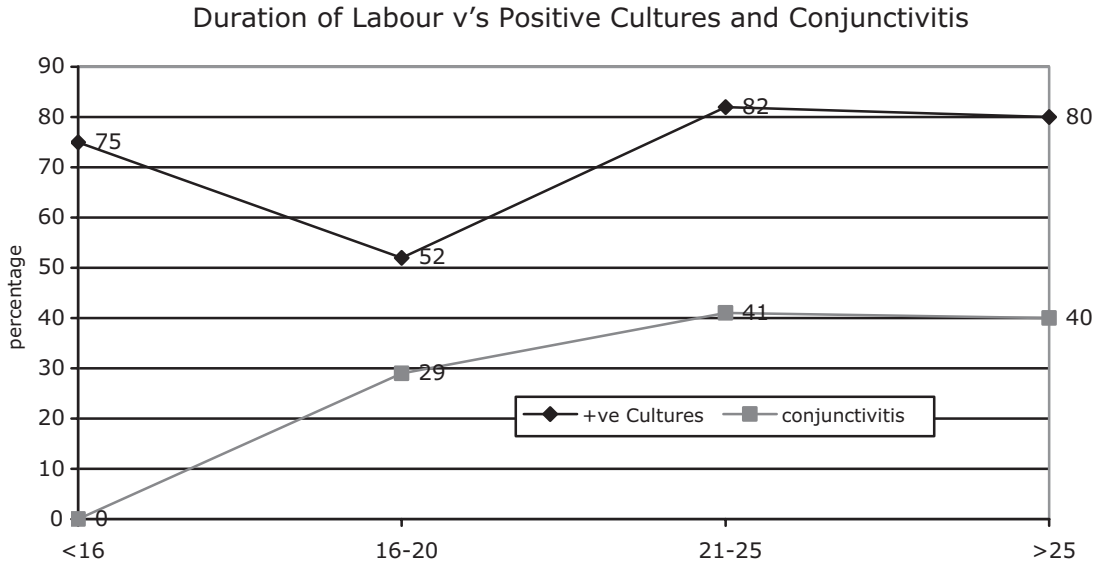
This figure shows the rates of developing conjunctivitis. 31% in the PL group, 23% in the controls. This however did not attain statistical difference. OR = 1.6 (0.26)

Figure 4 Relationship between neonatal conjunctivitis and conjunctival culture



This diagram shows distribution of newborns that developed conjunctivitis among those who had positive and negative conjunctival cultures in the two groups respectively. Those who had positive cultures developed conjunctivitis more than those who had negative cultures. PL odds ratio = 0.8(p value = 0.830), Controls OR = 2.73(0.130)

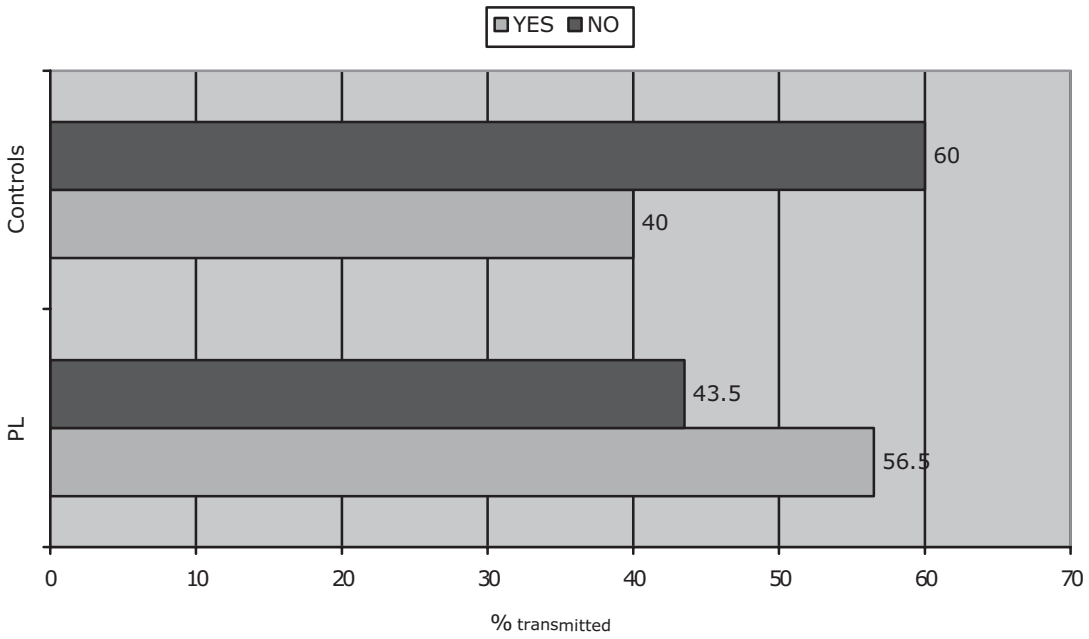
Figure5



This figure shows how the yield in conjunctival cultures, and development of conjunctivitis related to the length of time the prolonged labour took. The longer the duration of prolonged labour the higher the development of conjunctivitis (p-value 0.029). Culture positivity did not have a linear relationship with the length of labour

Figure 6

Transmission of Organisms from mother to newborns



This figure shows the rates of obtaining the similar organism both in the mother and the baby. Transmission occurred in 56.5% in PL group and 40% in the control group. The odds of transmission in the PL group were 1.95(p-value 0.270).

Table 1: Profile of Transmitted Organisms

Organism	PL(n=13)	Control(n=8)
	No. of similar pairs(%)	No. of similar pairs
Staph aureus	5 (38.5)	4 (50)
Staph .epidermidis	5 (38.5)	2 (25)
E. coli	2 (15.4)	1 (12.5)
Strep viridans	1 (7.6)	1 (12.5)

In both groups, Staph. aureus and Staph epidermidis constituted the largest proportion of organisms presumed to come from the mother to the baby.

Table 2: Profile of organisms isolated from the conjunctivae of the newborns

Organisms	PL (n = 34)		Controls(n = 28)	
	No. of newborns	%	No. of newborns	%
Staph. Epidermidis	13	38	14	50
Staph. Aureus	16	47	11	39
Strep. Pneumonia	2	6	0	0
Strep. Viridans	1	3	3	10.7
E. coli	3	9	1	3.6

DISCUSSION

In this study 54 cases in the prolonged labour group and 55 in control group were studied. On average, the mothers were of similar age and parity. However a slightly younger population was seen in the PL group (mode 18yrs) compared to 23yrs of those that delivered normally. Figure 1 shows the proportion of babies from whom positive conjunctiva cultures were obtained. In the PL group 63% (OR 1.9, p-value 0.09) of babies' cultures were positive compared to 51% of the controls. In a study done in Kikuyu hospital in 1991 – 1993 by Isenberg at al, it was found that 55% of patients with conjunctivitis were culture positive.[12] The higher frequency of positive cultures in PL as shown in this study clearly implicates it as a risk factor for conjunctival colonization. PL presents a situation in which the mother is subjected to repeated digital vaginal examinations. These might have exposed both the mother and the infant to microbial contamination. Figure 2, shows the trend of obtaining positive cultures with increasing age of the newborn. The longer, after birth, it took the examiner to take samples from the conjunctiva of the newborns, the higher the yield for positive cultures was obtained. Newborns of PL showed a steady rise in the number of positive cultures with increasing age (p-value 0.017). Newborns were colonized as early as the first 12 hours. As was illustrated by Duerden et al, newborns became colonized within hours of birth.[1] Culture positivity showed lower rise with increasing age in the control group, probably due to low initial colonization at the time of delivery. It would have been interesting to see the trend of colony counts. Colony counts were not done due to logistical constraints. Figure 3 shows incidence rates for neonatal conjunctivitis. The rate of developing conjunctivitis was higher in PL (31%) than in the controls (23%). Although the difference was not statistically significant, PL tended to give a higher risk. The average rate 23% found in the study corresponded with that quoted in earlier studies of 1986 by Fransen, Klaus et al, and in 1991 – 1993 by Isenberg et al [2] and therefore indicated that there had been no change in incidence in the last 10 years or so. Mothers in the control group were subjected to the routine methods of delivery. They may have undergone routine digital vaginal examinations. This might have exposed them to less microbial contaminants. As this group represented the usual scenario in the general ward set-up, it revealed that the problem also existed even in situations of normal delivery, and therefore emphasized the need for observing infection control in all deliveries. Ocular prophylaxis should be available to all neonates. Figure 4 illustrates how culture yields were, in those who developed conjunctivitis. Of those who developed conjunctivitis, 65% in the PL group, and 69% in the control group, had positive cultures. There was no statistical difference in the two groups. The possible explanation as shown in table 1 is that similar organisms, probably of similar virulence were involved in the two groups. Staphylococcal aureus and Staph. epidermidis were the most commonly transmitted organisms. Positive culture alone was therefore, not a good predictor for development of conjunctivitis. In a further attempt to explain the higher development of conjunctivitis in the PL group as shown in figure 3, we looked at the trend of obtaining positive cultures and developing conjunctivitis with the length of prolonged labour. In figure 5, we demonstrate that the longer duration of the prolonged labour, the higher the number of babies developed conjunctivitis (p-value 0.029). This was in keeping with other studies that showed that prolonged labour was related to higher neonatal sepsis. The possible explanation for this is that prolonged duration of labour was related to higher number of per-vaginal examinations, longer exposure of neonatal eyes to vaginal contaminants and flora, and due to in many cases of protracted labour, increased facial bruising. All these rendered the neonate susceptible to conjunctival infections.[8] Table 2 shows the types of organisms isolated from the neonates' conjunctiva swabs. In this profile, *Staph. aureus, Staph. epidemidis and strep. pneumonia*, were the leading three in the prolonged labour group. *Staph. epidermidis, staph. aureus,* and *strep. viridans* in the control group, in that order of frequency, were the most common isolates. These common species are the known skin florae, *Staphylococci*, which most probably came from the vaginal contaminants during delivery. These species could also have been acquired from the infant's post-delivery immediate environment. Most organisms showed resistance to Tetracycline, Kanamycin and Penicillins. The most effective drugs were Flouroquinolones, Augmentin, Tobramycin, Neomycin, Imipenem,Vancomycin and Ceftazidin.

CONCLUSIONS

1. Prolonged labour increased the risk of transmission of maternal vaginal flora to the eyes of the newborns
2. Positive conjunctiva cultures were obtained more frequently in prolonged labour (63%) than in controls (51%)
3. The rate of obtaining positive cultures had a direct correlation with the length of time, from birth, the conjunctiva samples were obtained.
4. The incidence rate of developing conjunctivitis was higher in prolonged labour (31%), than in normal population (23%). The rates of developing conjunctivitis also directly correlated with the duration of prolonged labour ($p = 0.029$)
5. The profile of organisms obtained in the conjunctiva of the newborns was *Staph. aureus, Staph. epidemidis* and *strep. pneumonia,* in the prolonged labour group and *Staph. epidermidis, Staph. aureus, and strep. viridans* in the normal population, in their order of frequency
6. Tetracycline, the most commonly used prophylactic antibiotic is no longer effective (showing 64% resistance in this study)

RECOMMENDATION

Since both groups showed a high rate of contracting conjunctivitis, antibiotic prophylaxis is recommended for all newborn babies. Effective drugs or compounds should be availed to all maternity hospitals. Infants of mothers with prolonged labour should be followed up closely in the first month of life.

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