Relation of myopia and retinal nerve fiber layer thickness: An ocular coherence tomography based study

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Abstract

Aim: To evaluate the relationship between the axial length and refractive error and peripapillary retinal nerve fiber layer (RNFL) thickness measured using Stratus optical coherence tomography (OCT) in subjects with high myopia.

Materials and Methods: It was a prospective comparative observational study. Eighty eyes of 40 non glaucomatous subjects aged between 18 to 51 years with spherical equivalent ≥ -6 dioptres (D) were examined during a period of 3 years. All subjects underwent a full ophthalmic examination. OCT was performed with OCT model 3000 version 48 (Stratus OCT, Carl Zeiss Meditec Inc.) Total average, quadrantic & mean clock hour RNFL thickness was measured with the fast RNFL (3.4) (768 A-scans in 1.92 seconds) scanning protocol. The same procedure was performed for 80 emmetropic eyes of 40 age matched subjects of the control group. Statistical analysis was performed with SPSS (version 11.5, SPSS, Chicago).

Results: Mean age of myopes was 28.4 years (SD +/-10.3). Mean spherical equivalent was -9.48125 (SD +/- 1.73), with mean axial length of 28.72 (SD +/-1.70). In the emmetropic control group, mean age was 26.9 years (SD 9.9) and mean axial length was 23.8 (SD +/-0.4). There was significant difference between axial length ($P<0.0001$) of the two groups. Mean average RNFL thickness in myopes was 73.27µm with standard deviation (SD) +/-19.33 µm. Mean average RNFL thickness in emmetropes was 98.5µm (SD +/- 12.9 µm). RNFL thickness decreased with higher axial length (overall $r2=0.016$, $P> 0.05$), but the correlation was not found to be statistically significant. No statistically significant associations were noted between mean RNFL thickness and age ($r2 = 0.017$, $p > 0.05$).

Conclusion: High myopic subjects tend to have thin peripapillary RNFL as measured by Stratus OCT. This phenomenon should be considered when interpreting a glaucoma suspect's RNFL measurements compared with the normative database which may be misleading in such cases resulting in a substantial proportion of false positive errors. The variation in the normal population needs to be taken into account to distinguish a pathologically from a physiologically thin RNFL. Stratified normal databases are required for accurate diagnosis of conditions resulting in nerve fiber loss such as chronic glaucoma.

Keywords: Myopia, OCT, RNFL.

Introduction

Ophthalmia neonatorum is conjunctivitis occurring to neonates less than 1 month of age, associated with eyelid edema, erythema and purulent discharge from eyes. In neonates, it is one of the most common infections.[1]

Neonatal conjunctivitis has been associated with various perinatal factors. Maternal factors include maternal anemia or nutritional deficiency during pregnancy, subclinical infections of the lower female genital tract during birth, premature rupture of membranes in preterm mothers.[2,3] Fetal and neonatal factors include respiratory failure, intrauterine growth retardation, premature birth, neonatal sepsis from; premature rupture of membranes, abruptio placentae, postpartum sepsis and low birth weight.[2]

The microorganisms causing neonatal conjunctivitis are from maternal genitourinary tract (*Chlamydia trachomatis* and *Neisseria gonorrhoeae),*[3] skin commensals (*Staphylococcus aureus*) and maternal gastrointestinal tract (*Pseudomonas sp*).[4]

After usage of Crede's method- instillation of Silver nitrate eye drops; for prophylaxis of gonococcal conjunctivitis in newborn, its rate has significantly decreased.[2] As Silver nitrate is not effective against *C. trachomatis*, inclusion blenorrhoea (*C.trachomatis* conjunctivitis) has become a major cause of neonatal conjunctivitis.[2] Besides, Silver nitrate also causes chemical conjunctivitis to some extent. Therefore, it has been replaced by 1%tetracycline, 0.5% erythromycin ointment or 2.5% povidone iodine drops as a prophylactic agent for ophthalmia neonatorum.[5] Although all these agents are equally effective for prophylaxis against *N.gonoeehoea*, 0.5% erythromycin ophthalmic ointment is the only drug approved for this indication by the U.S. Food and Drug Administration.[5]

We have tried to describe the maternal and neonatal risk factors associated with neonatal conjunctivitis as well as to assess treatment for the affected neonates. By describing the factors associated with neonatal conjunctivitis, interventions can be designed to reduce transmission of this preventable condition.

Materials and Methods

It is a prospective as well as retrospective study of 215 neonates visiting Ophthalmology OPD of our hospital with complaint of discharge from eye, out of which 100 neonates were taken retrospectively and 115 were taken prospectively. Thorough birth history was noted including time of labour, rupture of membranes,

mode of delivery, maternal genitourinary tract infection, birth weight, APGAR score and neonatal septicemia. Regurgitation test was performed and patients having positive regurgitation test were excluded from the study. Conjunctival swab was sent for Gram and Giemsa staining and culture sensitivity test. Patients were treated empirically with topical Tobramycin (0.3%) eye drops. The antibiotic was changed when required after the culture sensitivity report. The frequencies were calculated of various risk factors in neonates with ophthalmia neonatorum and their mothers.

Results

A total of 215 neonates were included in the study. The average age at presentation was 11.2 days (3 days to 30 days). Out of them, 77 (35%) patients were males and 138 (65%) were females. 127 (60%) neonates were born through spontaneous vaginal delivery and the rest 88 (40%) were born through caesarian section. One mother had history of premature rupture of membranes (PROM). No mother had history of active sexually transmitted infection. Ninety six (45%) patients had unilateral and one hundred nineteen (55%) patients had bilateral ocular involvement. All neonates were full term except one, preterm. 22 neonates (10%) had low birth weight. Six neonates suffered from neonatal septicemia. One had history of meconium aspiration at the time of birth. None had low (<7) APGAR score.

Bacteria were isolated from 40% of conjunctival smears. Out of them 68% were Gram positive cocci and the rest 32% were Gram negative bacilli. Staphylococcus aureus was isolated in 40 (46%) cases out of which 4 (4.6%) were MRSA (Methicillin resistant Staphylococcus aureus), Staphylococcus epidermidis in 18 (20%) cases, Pseudomonas aeruginosa in 20 (23%) cases and other Gram negative bacilli in 8 (9%) cases. Fortunately, there was not a single case of N. gonorrhea or C. trachomatis. (Illustration 1)

All the patients responded to the prescribed antibiotic and no complications were noted.

Discussion

Ophthalmia neonatorum caused by N gonorrhoeae and C trachomatis is responsible for severe visual loss. Fortunately, their rates have declined significantly because of routine antenatal screening and timely treatment of sexually transmitted infections as well as decreased prevalence of these infections in the general population.[6,7] In our study, neither of these two bacteria was isolated from the conjunctival smears. Low birth weight was the leading risk factor for the neonates. The infection was common in those born through vaginal delivery than through caesarean section. (P <0.05%; Z test)

In the US, N gonorrhoeae accounts for <1% of reported cases of neonatal ophthalmia, Chlamydia trachomatis accounts for 2% to 40%, while Staphylococcus species, Streptococcus species, Haemophilus species and other Gram-negative bacterial species account for 30% to 50% of cases.[8] An Indian study of 70 neonatal ophthalmia cases from 2002 isolated 57% Staphylococcus epidermidis, 24% Chlamydia trachomatis and the rest 35% other bacteria.[9] Another Indian study of 58 neonates isolated Chlamydia trachomatis in 31% of neonatal conjunctivitis cases.[2]

At our hospital, all the mothers undergo regular antenatal visits with screening for STIs. Patients having leucorrhea are investigated further and treated accordingly. However there is no protocol to give STI prophylaxis as a routine to all cases.

The test used to identify C trachomatis in our study was Giemsa staining for identification of inclusion bodies. This test although having high (97%) specificity, has low sensitivity (38%).[10] The unavailability of other tests like DIF (Direct immunofluorescene) and PCR (Polymerase Chain Reaction) is a limitation of our study.

Currently, there is a controversy regarding regular use of prophylactic topical antibiotics for Ophthalmia neonatorum worldwide. Topical erythromycin, tetracycline and povidone iodine can be used for the prophylaxis. However, these agents are found effective only for gonococcal ophthalmia and not against Chlamydia.[8] *Darling et al* found that there is no significant difference in the efficacy of silver nitrate, topical erythromycin and no prophylaxis in preventing ophthalmia neonatorum.[6] It is more important to recognize STIs prenatally and treat promptly to decrease the possibility of development of the disease; instead of prophylaxis. Mothers who were not screened previously, should be checked for at the time of delivery and their infants should be given ceftriaxone if their mothers are found having gonococcal infection. Infants exposed to chlamydia at delivery should be followed closely for signs of infection. Proper antenatal care to reduce incidence of low birth weight babies as well as educating hygiene protocol to healthcare staff and caretaker of the neonate can reduce hospital acquired infection.

In conclusion, improving prenatal care to reduce sepsis and early diagnosis and treatment of STI may decrease transmission of neonatal conjunctivitis. Proper antenatal care is equally necessary to focus on reducing low birth weight babies which is an important causative factor. Educating hygiene protocol to healthcare staff and caretaker of the neonate and its implementation can reduce hospital acquired infection.

References

1. Scott R Lambert. Philadelphia; Elsevers Saunders: 2005. Conjunctivitis of the newborn (Ophthalmia Neonatorum) pp. 146–8. David Taylor & Creig S Hoyt. Pediatric Ophthalmology and Strabismus.
2. Kakar S, Bhalla P, Maria A, Rana M, Chawla R, Mathur NB. Chlamydia trachomatis causing neonatal conjunctivitis in a tertiary care center. Indian J Med Microbiol. 2010;28:45–7.

3. Bergstrom S. Infection-related morbidities in the mother, fetus and neonate. J Nutr. 2003;133(5 Suppl:1656S–60.
4. Akera C, Ro S. Medical concerns in the neonatal period. Clinics in Family Practice. 2003;5((2)):265–92.
5. Rogers LK, Baker CJ, Kimberlin DW, Long SS. Red Book 2009 Report of the Committee on Infectious Diseases. 28th ed. Elk Grove Village, ILL: American Academy of Pediatrics; 2009. pp. 827–9.
6. Darling EK, McDonald H. A meta-analysis of the efficacy of ocular prophylactic agents used for the prevention of gonococcal and chlamydial ophthalmia neonatorum. J Midwifery Womens Health. 2010;55(4):319–27.
7. Gray J. Executive Director, Canadian Medical Protective Agency. June 2013. Personal communication.
8. Prevention of neonatal ophthalmia. Pickering LK, Baker CJ, Kimberlin DW, Long SS, editors. Red Book: 2012 Report of the Committee on Infectious Diseases. 29th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2012. pp. 880–2.
9. Mohile M, Deorari AK, Satpathy G, Sharma A, Singh M. Microbiological study of neonatal conjunctivitis with special reference to *Chlamydia trachomatis*. Indian J Ophthalmol 2002;50:295-9.
10. Fahimeh Asadi-Amoli, Zohreh Nozarian, Vahid Mehrtash, Hooshang Beheshtnejad and Avishan Shabani. Comparison of Direct Immunofluorescence and Giemsa Staining in Chlamydia trachomatis Follicular Conjunctivitis. Zahed an J Res Med Sci. 2015 October; 17(10).