ORIGINAL RESEARCH ARTICLE

Tear Film Functions and Intraocular Pressure Changes in Pregnancy.

Waheed A Ibraheem[1], Anifat B Ibraheem[2], Aramide M. Tijani[3], Samuel Oladejo[1], Susan Adepoju[1] and Bukola Folohunso[1]*

Department of Ophthalmology, Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso[1]; Department of Family Medicine, Jericho Specialist Hospital, Ibadan[2] ; Department of Obstetrics & Gynecology, Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso[3].

For Correspondence:** *E-mail:** hanny4demmy@gmail.com; Phone: +234 806 3692 364,

Abstract

Pregnancy related ocular changes are diverse with varied clinical outcome. In a cross-sectional, descriptive case control study, we evaluated tear film functions and intraocular pressure during pregnancy and compared the results with non-pregnant women. A total of 270 participants including 165 healthy pregnant women and 105 non-pregnant who were free from systemic and pre-pregnancy eye diseases were investigated. Snellen's chart, fluorescein dye, No 41 Whatman filter paper, Perkin's tonometer were employed to assess visual acuity, tear break up time (TBUT), Schirmer's test (ST), intraocular pressure (IOP) on all subjects. The mean values for IOP (mmHg), TBUT (seconds) and Schirmer's reading (mm) were: 13.24±2.18, 25.05±9.30, 37.03±17.06 and 14.24±2.66, 22.10±10.81, 50.13±19.10 for cases and controls respectively. Schirmer's reading (SR) was significantly lower among pregnant women. Only age had a statistically significant association with the measured parameters. Our study revealed reduced SR during pregnancy. We suggest routine ocular assessment for pregnant women to forestall deleterious sequelae of dry eye. *(Afr J Reprod Health 2015; 19[4]: 118-122).*

Keywords: Tear break-up time, Schirmer's test, intraocular pressure, pregnancy

Résumé

Les changements oculaires liés à la grossesse sont diverses ayant le résultat clinique variée. Dans une étude de contrôle de cas descriptive et transversale, nous avons évalué les fonctions de film lacrymal et la pression intraoculaire pendant la grossesse et avons comparé les résultats avec les femmes non enceintes. Un total de 270 participantes, dont 165 femmes enceintes en bonne santé et 105 femmes non enceintes qui étaient exemptes de maladies systémiques et oculaires, ont été étudiés. Le tableau de Snellen, la fluorescéine, Numéro 41 filtre Whatman, le tonomètre de Perkin ont été utilisés pour évaluer l'acuité visuelle, le temps de la déchirure (TD), test de Schirmer (TS), la pression intraoculaire (PIO) sur tous les sujets. Les valeurs moyennes de PIO (mmHg), Les indications (mm) de TD (secondes) et les indications selon Schirmer étaient: 13.24 ± 2.18, 25.05 ± 9.30, 37.03 ± 17.06 et 14.24 ± 2.66, 22.10 ± 10.81, 50.13 ± 19.10 pour les cas et les témoins, respectivement. Les indications selon Schimmer (SR) étaient significativement plus faibles chez les femmes enceintes. Seulement l'âge avait une association statistiquement significative avec les paramètres mesurés. Notre étude a révélé une SR réduite pendant la grossesse. Nous préconisons l'évaluation oculaire de routine pour les femmes enceintes pour prévenir les séquelles néfastes de la sécheresse oculaire. *(Afr J Reprod Health 2015; 19[4]: 118-122).*

Mots-clés: Temps de la déchirure, test de Schirmer, pression intraoculaire, grossesse

Introduction

Pregnancy is marked with maternal endocrine up-regulation, hormonal profile modifications and interactions[1]. These are required for appropriate anatomical and physiological adaptations needed for optimal fetal development, nourishment and smooth delivery at term[2]. However, the physiological effects of these hormones often go beyond reproductive system and affect other organs including eye and its adnexae[3]. In the eye, all structures could be affected ranging from anterior segment to the posterior segment[4,5]. In the anterior segment, tear film and intraocular pressure are often affected. However, while the intraocular pressure response to pregnancy is usually hypotensive, a potential benefit for those with ocular hypertension or glaucoma, the

accompanied changes in lacrimal function is usually negative[6,7]. Not surprisingly, higher prevalence of dry eye had been reported both in human and experimental studies during pregnancy[6].

At present, there is dearth of data on pregnancy-related ocular changes in South-Sahara Africa particularly in Nigeria, hence the need for this study to explore ocular response to pregnancy among Nigerian women and produce relevance information on the subject. Some sequelae of dry eye disease (a known disorder in pregnancy) such as keratopathy could be vision threatening[5]. By this study, we aim to describe tear film functions and intraocular pressure in pregnancy. The outcome of this study is expected to further create awareness on pregnancy related ocular changes. And this will facilitate early recognition and prompt treatment where necessary.

Methods

Study Design

The study is a cross-sectional, descriptive case contol study.

Sampling Techniques

One hundred and sixty five pregnant women without selection for gestational age, and100 non-pregnant patients (controls) were selected for the study.

Ethical consideration: The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 1983

Inclusion criteria

All pregnant women irrespective of the age who were free from all form of systemic or ocular disease that can affect tear film function such as blepharitis, conjunctivitis, preexisting glaucoma, use of topical eye medication within three months before presentation were included.

Instruments and Methods of Data Collection

Schirmer's Test

The eye was mobbed dry and the folded end of a 35mm long and 5mm wide pre-calibrated (mm) Whitman no 41 paper was gently inserted into the junction between the lateral 1/3rd and medial 2/33rd of the lower fornix without touching the cornea. The extent of the wetting (mm) after 5 minute using stop watch was recorded as the tear film function.

Tear break up time

Two percent (2%) sodium fluorescein solution was gently instilled into the inferior fornix of the subject. Respondent was asked to blink several times in order to distribute the fluorescein evenly. Under broad beam and blue cobalt light, the time interval (seconds) between the last blink and the appearance of first randomly distributed black spot on the cornea was noted using a stop watch. This was done thrice in succession for each eye and the mean was taken as the final reading.

Intraocular Pressure

Done in sitting position and the right eye measured first in accordance with convention. A drop of local anesthetic agent (tetracane) was gently instilled into the lower fornix of the subject. After 3 minute, a drop of sodium fluorescein dye was instilled into the inferior fornix and the subject was asked to blink gently to ensure even spread of the dye across the cornea surface. Thereafter, the intraocular pressure was measured with the use of a standardized hand held Perkins (Perkins Tonometer Mk2, HS Clement Clarke International, Haag Streit UK Ltd. CE0120). The measurement was done twice by the investigator and the mean was taken as the final value.

Data Analysis

The obtained data were entered and analyzed with SPSS software version 17. Variables were summarized using mean and standard deviation. Data were presented in tables, and student t-test

was used to compare the mean between the cases and controls. The level of statistical significance (p) was set at 5%.

Results

A total of 270 women consisting 165 pregnant women (cases) and 105 non-pregnant women (control) who were free from systemic and ocular diseases were recruited. The mean ages (year) for cases and control groups were 29.32±4.80 and 36.63±7.57 respectively.

The mean values of TBUT, SR and IOP were shown in Table 1. There was statistically significant difference in the obtained values between the two groups.

Table 2 shows the mean values for the right and left eyes for the enrolled populations. There was a statistically significant difference between each eye across the two groups.

Table 1: Comparison of Ocular Parameters among Cases and Controls

Ocular parameter	Cases (165)	Control t-test(105)	t-test	p-value
Mean Intraocular pressure ±SD (mm Hg)	13.24±2.18	14.24±2.66	-3.36	0.001*
Mean Schirmer's reading ±SD (mm)	25.05±9.30	22.10±10.81	2.39	0.018*
Mean Tear break up time ±SD (second)	37.03±17.06	50.13±19.10	-5.85	0.000*

Table 2: Comparison of Ocular Parameters among Cases and Controls

Variables (Mean±SD)	Cases (167)	Control (105)	t-test	p-value
Right Intraocular pressure	13.17±2.21	14.11±2.71	-3.12	0.002*
Left Intraocular pressure	13.34±.17	14.33±2.50	-3.39	0.001*
Right Schirmer's reading	24.44±10.23	21.36±11.69	2.28	0.023*
Left Schirmer's reading	25.56±9.84	22.88±11.15	2.08	0.039*
Right Tear break up time	36.58±18.28	47.63±19.98	-4.68	0.000*
Left Tear break up time	37.76±18.72	52.64±20.85	-6.11	0.000*

Discussion

The ocular response to pregnancy is diverse and complex[5,6,7]. However, for the intraocular pressure (IOP), the trends in earlier studies are reduction. Goldich et al investigated ocular anterior segment changes in pregnancy and non-pregnant women. They submitted that intraocular pressure was significantly lower in the former group[8]. Similarly, Atas and co-investigators studied fifty-four healthy pregnant women in their third trimester and a statistically significant low IOP was noted among the studied population[9]. In Eastern part of Nigeria, Ebeigbe et al conducted a longitudinal case control study on 117 pregnant women and non-pregnant women. A continuous fall in IOP was observed throughout the pregnancy and the difference in mean IOP between the pregnant and non-pregnant women was statistically significant[10].

In concordance with these previous summations, we also found a lower IOP (13.24±2.18 versus 25.05±9.30, p=0.001) among our cases and the difference between the 2 groups (cases and controls) was statistically significant.

Several theories had been advanced for the pregnancy related ocular hypotension. One of such postulations is decrease episcleral venous pressure with attendant upregulation of aqueous humor drainage despite normal production[11]. This phenomenon is believed to be related to increased progesterone[11,12], enhanced production of nitric oxide (NO), endothelin-I and eicosanoids[13]. While progesterone exerts its hypotensive effect by antagonizing endogenous corticosteroid hormone which has ocular hypertensive action, [12]NO, endothelin-1 and eicosanoids achieve similar action via generalized vasodilation including the episcleral blood vessels and consequently improved drainage[13].

The role of human chorionic gonadotrophins (HCG) hormone in pregnancy related ocular hypotension has been previously examined[14]. In a study conducted among postmenopausal women with glaucoma, reduced IOP was noted after the administration of HCG[14]. Similarly, in an

experimental study conducted on rabbits, a significant fall in IOP was observed after intravitreal/ intravenous administration of HCG to normal or ovariectomized rabbits[12]. HCG produces ocular hypotension by stimulating the production of cyclic adenosine monophosphate (cAMP) which in turn decreases aqueous humor production[12].

In this study, the observed ocular hypotension among our cases is most likely due to increased production of progesterone and Nitric oxide during pregnancy. Additionally, the ligament softening action of relaxin, an essential hormone required for easy passage of child through birth canal may extend to other ligaments in the body including the suspending ligaments of the eye coat thereby reducing sclera rigidity with attendant decrease IOP[15,16].

Tear film functions changes during pregnancy had been widely investigated with consistent evidence indicating that dry eye is more prevalent during pregnancy[17-20]. Using Schirmer's test and dry eye questionnaire, Skare and co-researchers assessed the prevalence of lacrimal dysfunction during pregnancy and compared it with non-pregnant women. Although, a higher prevalence of dry eye was reported among the pregnant, there was no different in Schirmer's reading between the 2 groups[6]. In animal model, Ding and co-investigators explored the association between pregnancy and dry eye symptoms (DES) and a significantly higher DES was demonstrated in pregnant rabbits[7]. In agreement with earlier investigators, we also noticed reduced tear break up time (TBUT) among our pregnant respondents. However, contrary to other study[6], our data revealed a statistically significant higher Schirmer's reading in the pregnant group. This may be due to the fact that most of our cases were in their early gestational period and that hormonal upregulation has not reach the required concentration to affect lacrimal gland.

The mechanism behind the secretion of tear film components had been object of investigation for several years. And research has shown that for optimal functioning of meibomian glands, a delicate balance between pro secretory (testosterone) and anti-secretory hormones (estrogen) must be actively protected[21,22]. This is because while testosterone enhances the development and differentiation of this gland, estrogen promotes acinar cell death leading to reduction in size of the gland and decrease in secretion[21,22]. In pregnancy, though there is an upregulation in the secretion of estrogens, progesterone and testosterone, there is also a simultaneous increase in testosterone binding protein (TBP) with attendant depletion of biologically active free testosterone[23]. Additionally, the sharing of the same cellular receptor by small biologically active testosterone and high level of progesterone further aggravate the reduced pro-secretory activity of testosterone on meibomian glands[22,24].

We postulate that the hormonal imbalance during pregnancy affect meibomian gland earlier than the lacrimal gland. A further study is desirable to examine the association between the concentrations of various maternal hormones, gestational age and tear film function in pregnancy.

Conclusion

Our finding further established the presence of ocular changes in pregnancy. The implication of this to the policy maker is that appropriate policy should be put in place to encourage routing ocular examination during pregnancy. For the clinicians, there is need for the trainees in obstetrics to acquire some basic eye examination skills in order to be able to identify pregnancy related ocular changes early in their course.

Acknowledgement

We appreciate the support received from the entire staff of obstetrics and ophthalmology clinics of LAUTECH Teaching Hospital, Ogbomoso.

Declaration

Nil interest to declare

Contribution of Authors

Waheed A. Ibraheem and Anifat A. Ibraheem conceived and designed the study, supervised data collection, entry and analysis and wrote the

manuscript. Aramide M. Tijani, Samuel Oladejo, Susan Adepoju and Bukola Folohunso supervised the process of conceptualization and data collection. All authors approved the manuscript.

References

1. Garg P, Aggarwal P. Ocular changes in pregnancy. Nepal J Ophthalmol. 2012;4(1):150-61.
2. Omoti AE, Waziri-Erameh JM, Okeigbemen VW. A review of the changes in the ophthalmic and visual system in pregnancy. Afr J Reprod Health. 2008;12(3):185-96.
3. Pilas-Pomykalska M, Czajkowskii J, Oszukowski P. Ocular changes during pregnancy. Ginekol Pol. 2005;76(8):655-60.
4. Goldich Y, Cooper M, Barkana Y, Tovbin J, Lee Ovadia K, Avni I, Zadok D. Ocular anterior segment changes in pregnancy. Journal of Cataract & Refractive Surgery. 2014;40(11):1868-71
5. Akar Y, Yucel I, Akar ME, Uner M, Trak B. Long-term fluctuation of retinal sensitivity during pregnancy. Can J Ophthalmol. 2005;40(4):487-9
6. Skare TL, Gehlen ML, Silveira DMG, Uema MMDS. Pregnancy and lacrimal dysfunction. Rev. Bras. Ginecol. Obstet. 2012;34(4):170-4
7. Ding C, Lu M, Huang J. Changes of the ocular surface and aquaporins in the lacrimal glands of rabbits During pregnancy. Mol Vis. 2011;17:2847-55.
8. Goldich Y, Cooper M, Barkana Y, Tovbin J, Lee Ovadia K, Avni I, Zadok D.Ocular anterior segment changes in pregnancy. J Cataract Refract Surg. 2014;40(11):1868-71.
9. Ataş M, Duru N, Ulusoy DM, Altınkaynak H, Duru Z, Açmaz G etal. Evaluation of anterior segment parameters during and after pregnancy. Cont Lens Anterior Eye. 2014;37(6):447-50.
10. Ebeigbe JA, Ebeigbe PN, Ighoroje AD. Intraocular pressure in pregnant and non-pregnant Nigerian women. Afr J Reprod Health. 2011;15(4):20-3
11. Pilas-Pomykalska M, Luczak M, Czajkowski J, Woznjak P, Oszwkowski. Changes in intra ocular pressure during pregnancy. P Klin Oozna. 2004;106(1-2): 238-9.
12. Ziai N, Ory SJ, Khan AR, Brubaker RF. ß -HCG, progesterone and aqueous dynamics during pregnancy. Arch Ophthalmol. 1994;112(6):801-6.
13. Pitta Paramjyothi, A.N.R. Lakshmi, D. Surekha. Physiological changes of intraocular pressure (IOP) in the second and third trimesters of normal Pregnancy Journal of Clinical and Diagnostic Research. 2011;5(5):1043-5.
14. Sears ML, Mead A. A major pathway for the regulation of intraocular pressure. Int Ophthalmol Clin. 1983;6:201-5.
15. Phillips CI, Gore SM. Ocular hypotensive effect of late pregnancy with and without high blood pressure. Br J Ophthalmol. 1985;69(2):117-119.
16. Ch EY, Moon JI. Intraocular pressure change in the pregnant glaucoma or ocular hypertension patients and normal women. Korean J Ophthalmol. 2004;45:1880
17. Wong J, Ding C, Yiu S, Smith R, Goodwin T, Schechter JE. An epidemiological study of pregnancy and dry eye. Ocul Surf. 2004;3:S127.
18. Priori R, Medda E, Conti F. Risk factors for Sjogren's syndrome: an Italian case-control study. IX International Symposium on Sjogren's Syndrome; Washington, DC. April 27–29, 2006; p. 64.
19. Priori R, Medda E, Conti F, Cassarà EA, Sabbadini MG, Antonioli CM, et al. Risk factors for Sjögren's syndrome: a case-control study. Clin Exp Rheumatol. 2007;25:378–384.
20. Ding C, Chang N, Fong YC, Wang Y, Trousdale MD, Mircheff AK, et al. Interacting influences of pregnancy and corneal injury on rabbit lacrimal gland immunoarchitecture and function. Invest Ophthalmol Vis Sci. 2006;47:1368–75.
21. Duarte MCB, NT Pinto, Moreira H, Moreira ATR, Wasilewski D. Total testosterone level in postmenopausal women with dry eye. Arq Bras Oftalmol.2007;70(3):465-9.
22. Kanova N, Bicikova M. Hyperandrogenic states in pregnancy. Physiol Res 2011;60(2):243-52.
23. MA Rivarola, MG Forest, Migeon CJ. Testosterone, androstenedione and dehydroepiandrosterone in plasma During pregnancy and at delivery: concentration and protein binding. J Clin Endocrinol Metab. 1968;28(1):34-40.
24. Choi JR, Levine D, Finberg H. Luteoma of pregnancy: sonographic findings in two cases. J Ultrasound Med2000;19(12):877-81.