

DOI: <http://dx.doi.org/10.18203/2320-1770.ijrcog20161294>

Research Article

Intraocular pressure variation in pregnancy: a prospective study

Lalith Sundaram, Sruthi Swaminathan*, Ranjakumar TC, Rahana Ashraf

Department of Ophthalmology, Kannur Medical College, Kerala, India

Received: 07 February 2016

Revised: 14 March 2016

Accepted: 18 March 2016

*Correspondence:

Dr. Sruthi Swaminathan,

E-mail: srutz27@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: To detect Intra Ocular Pressure (IOP) in each trimester of pregnancy and evaluate difference in measurement of intraocular pressure in each trimester of pregnancy.

Methods: 100 healthy pregnant women within age group ranging from 21 to 35 years were included in the study. Intra ocular pressures (Goldmann-Appplanation Tonometer) were calculated at 3 time periods: First trimester, Second trimester, Third trimester. Informed consent was taken from all patients. Patients had no systemic or ocular co-morbidities. All of the patients underwent comprehensive ophthalmologic examinations, including Refraction, Intraocular pressure (IOP), Anterior segment and Fundus examination.

Results: The mean age was 25 years in the study group. The mean IOP in the second trimester of pregnancy was measured to be reduced than first trimester by 9.33% & 20.33% by third trimester in right eye & decrease of 14.2% in second trimester and 28.84% in third trimester left eye. The results are statistically significant confirmed by ANOVA.

Conclusions: Changes during pregnancy causes variation in IOP which is observed in pregnant women resulting from increased water retention during pregnancy. Monitoring of IOP during pregnancy is also important in management of glaucoma patients and their medication. Most of the changes are reversible and resolved in the postpartum period or after cessation of breastfeeding. Awareness of the changes during pregnancy and routine screening during antenatal period should be improvised.

Keywords: IOP, Goldmann Applanation Tonometer, Pregnancy

INTRODUCTION

Changes in eye during pregnancy are vivid with most variations occurring in the intraocular pressure and central corneal thickness.^{1,2} It can even occur for the first time in pregnancy.

Only very few studies are done which indicate the effect of pregnancy on the IOP changes.

During pregnancy various changes in hormonal, immunological, metabolic, hematologic and cardiovascular status can be observed. Ocular changes in pregnancy are related to adnexa of the eye, anterior and posterior segment and can cause decreased intraocular pressure.

Temporary, transitory, and completely transient or in some cases even permanent changes are noticed in the course of pregnancy.¹⁻⁴

Pregnancy involves a number of endocrine interactions. In our study to observe the possibility of physiological changes of IOP which could be a predisposing factor or development, early detection, changes in IOP during pregnancy and also in management of glaucoma during pregnancy. The ocular effects of pregnancy may be physiological or pathological. It can be associated with the development of new ocular pathology or may be modifications of pre-existing conditions.¹⁻⁵

METHODS

The prospective study has been conducted in Department of Ophthalmology, Kannur Medical College, and a

tertiary care centre in Malabar Region of Kerala during period of 1 year with 100 Antenatal patients (200 eyes: 21-35yrs) diagnosed with pregnancy without any co-morbid conditions and ocular pathology.

Randomly selected patients (21-35years) who have given an informed consent for the study will be included. A pre structured proforma is used to collect the baseline data which included, Questionnaire for screening the pregnant women, Investigation with follow up in each trimester.

Pregnant women aged between 21-35 years coming for antenatal check-up in Obstetrics and Gynecology OPD, Kannur medical college, Kannur during a period of 1 year between years 2014-2015.

Pregnant women of 1st trimester were randomly chosen who come for antenatal check up to the centre. Each pregnant woman is then evaluated for complete eye examination using the Visual acuity, retinoscopy, auto refraction, Applanation tonometer and slit lamp evaluation.

Inclusion criteria

- Pregnant women aged between 21 to 35 years.
- Pregnant women who are consenting for the study.

Exclusion criteria

- *Pregnant women:* Age less than 21 years or more than 35 years.
- Non ambulatory.
- Having co morbid systemic conditions, diagnosed and under treatment of ocular pathology, undergone previous Ocular surgery.

Data collection process

- All pregnant women between the age group of 21-35years satisfying the above criteria were evaluated and taken for the study with consent. Subjects were then followed in subsequent trimester of that pregnancy and similar parameters are recorded. We examined 100 consecutive pregnant women (200 eyes) with uncomplicated singleton pregnancies and with no history of any ocular diseases or systemic diseases, and no history of past ocular surgeries. They underwent concurrent ophthalmic examinations. The study was approved by the Ethics Committee of the Kannur Medical College, Kannur, and informed consent was obtained from each participant.
- Pregnant women of 1st trimester are randomly chosen who come for ANC to ophthalmology OPD at the center. Each pregnant woman was then evaluated for Visual acuity testing using Snellen's chart for distant vision and Jaeger's chart for near vision, Dry retinoscopy, Auto-refraction, IOP with Applanation

tonometry & Fundus evaluation using 90D lens. A patient with any ocular pathology during the course of study was dropped from the study.

- The participants were called prior to their scheduled appointment. Complete ophthalmologic examinations, including the recording of best-corrected visual acuity, refraction, anterior segment and fundus examinations. IOP were repeated & performed every 3 months during pregnancy (beginning at the first 10 weeks of pregnancy) and in their subsequently one visit any time in each trimester. The right and left eyes were measured separately. All measurements were performed by the principal investigator in the following order: visual acuity, auto refraction, applanation tonometry and anterior segment, fundus evaluation.
- IOP was measured using the Carl Zeiss Goldman Applanation tonometer. The average of 3 consecutive readings in auto mode was used for the data analysis.

Statistical methods

- Descriptive and inferential statistical analysis has been carried out in the present
- Study results on continuous measurements are presented on Mean, SD and results on
- Categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. The following assumptions on data are made, Assumptions: (1) Dependent variables should be normally distributed (2) Samples drawn from the population should be random.

Statistical software

The Statistical software namely SPSS 17 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

Data analysis

Descriptive table was generated and appropriate statistical analysis was done using SPSS17.0 ANOVA (Analysis of Variance) was applied to compare the CCT in different phases of pregnancy. A significance level of p value < 0.05 was considered for the ANOVA. The data were expressed as mean \pm standard deviation

RESULTS

A total of 100 subjects of the age-group of 21-35 years participated in this study. The IOP of the pregnant women the variation was compared in each trimester. There was a significant decrease in the IOP in the third trimester of pregnancy ($p < 0.0001$) as compared to that in the second trimester of pregnancy. The results have been mentioned in the following Tables 1 and 2.

The mean age was 25 years in the study group. (SD: 3.928). 65% were primigravida and 35% multigravida.

Table 1: Comparison of variation in IOP in each trimester: right eye.

Group	Trimester	Mean intraocular pressure mmhg	Standard deviation	P value
Right eye	First trimester	13.92	2.111	P=0.001
	Second trimester	12.62	1.476	P=0.001
	Third trimester	11.09	1.083	P=0.001

Table 1: Comparison of variation in IOP in each trimester: left eye.

Group	Trimester	Mean intraocular pressure mmhg	Standard deviation	P value
Left eye	First trimester	14.70	1.661	P=0.001
	Second trimester	12.61	1.476	P=0.001
	Third trimester	10.46	1.077	P=0.001

DISCUSSION

Hormonal and circulatory changes during pregnancy could play a role in pregnancy changes in eye. The increased levels of estrogen, progesterone and other placental hormones during pregnancy may play an important role in maintaining the IOP.^{1,6-8}

IOP may affect women of childbearing age. A decrease in intraocular pressure has been observed during pregnancy and often persists for few months after delivery. The decrease in IOP can lead to changes in women with pre-existing glaucoma which can improve during this period however medications have to be continued.

During pregnancy, the aqueous production is normal, but the facility of the aqueous out flow is increased because of the influence of increased progesterone and the beta subunit of the HCG levels and decreased episcleral venous pressure which is related to a generalized reduction in the peripheral vascular resistance. This result in a gradual, statistically significant fall of the IOP during pregnancy.⁶⁻⁹ Progesterone has glucocorticoid antagonistic properties and this antagonistic action helps in the lowering of the IOP. The changes in the aqueous dynamics are consistent with the hypothesis that excess progesterone, during pregnancy, blocks the ocular hypertensive effect of endogenous corticosteroids.¹⁰

Possible mechanisms include increase in outflow as a result of hormone levels modification, a decrease in systemic vascular resistance, decrease in episcleral venous pressure; increased tissue elasticity, generalised acidemia and physiological changes in late pregnancy may reduce corneal rigidity, making the results of applanation tonometry falsely low. Likewise an increase in corneal thickness could also affect the measured values of IOP.⁸⁻¹³

Aqueous humour formation & its production remained stable, whereas IOP decreased throughout the trimesters and returned to normal levels at 3 months postpartum. Proposed mechanisms underlying the decrease in IOP during pregnancy indicate an association between female hormones and increased outflow.^{3,13,14}

A marked increase in aqueous outflow facility can be associated with progesterone levels in pregnancy. The decrease in IOP with the use of progesterone or the combination of progesterone and estrogen at pharmacologic doses is also reported. Another hypothesis suggests that excess progesterone during pregnancy acts as a glucocorticoid receptor antagonist and that it blocks the ocular hypertensive effect of endogenous steroids.¹¹

Intramuscularly administered relaxin, which is pregnancy-associated hormone, is shown to decrease IOP via increased outflow facility in both male and female patients with glaucoma. The effect of relaxin on outflow facility is thought to be mediated by collagen changes, which in turn affect the rigidity of Schlemm's canal and the trabecular meshwork.^{11,12}

Episcleral venous pressure has been reported to decrease in pregnant women could be associated with a decrease in general peripheral vascular resistance during pregnancy and might contribute to a decrease in IOP.^{13,14}

In our study, the mean IOPs in the second and third trimesters of pregnancy right eye were found to be lower than first trimester by 9.33% and 20.33% respectively & 14.2% and 28.84% left eye.

The mean IOP measurement was ($p < 0.001$) in 3d trimester. Mean IOP in first trimester 13.92mmhg (SD: 2.111), 12.62mmhg (SD: 1.476), 11.09mmhg (SD: 1.083) right eye 1st, 2d and 3d trimester and 14.70mmhg (SD: 1.661), 12.61mmhg (SD: 1.476), 10.46mmhg (SD: 1.077) left eye.

Razeghinejad MR, Tania Tai TY et al said Glaucoma, primarily a disease of the older population, may affect women of childbearing age. Pregnancy affects the intraocular pressure (IOP) of women with pre-existing glaucoma. Both elevations and reductions of IOP have been reported during pregnancy.¹¹

The physiological changes in late pregnancy may reduce corneal rigidity, making the results of applanation

tonometry falsely low. Likewise an increase in corneal thickness could also affect the measured values of IOP. However it should be emphasized that despite the apparent reduced IOP level in pregnant women many glaucoma patients still need to continue treatment since glaucoma damage may advance during pregnancy and progressive visual field loss can occur.¹⁵ This ocular hypotensive effect seems to increase until delivery and may persist for several months postpartum.¹²⁻¹⁵

A greater reduction of intraocular pressure was noted among pregnant women with baseline ocular hypertension in one study.¹⁴ Another investigation showed that the reduction in intraocular pressure was greater among multigravida than primigravida women.¹³

IOP for the post-partum period could not be checked due to difficulty of follow up of patients. However literature supports the resolution of the same after pregnancy.¹⁻¹⁰

CONCLUSION

Intraocular pressure changes is one of the main changes occurring in the eye which is usually reversible and resolved in the postpartum period or after cessation of breastfeeding

Routine monitoring of these parameters will be helpful to manage glaucoma patients during pregnancy. Antenatal check-up & must involve ophthalmic examination as a part of screening tool for detecting the changes in eye during pregnancy.

Monitoring of IOP during each trimester of pregnancy also has significance in managing glaucoma patients during pregnancy. Routine antenatal check-up & must involve ophthalmic examination as a part of screening tool for detecting the changes in eye during pregnancy. Different analytical approaches to this typed study could add to the validity and predictability of the future studies.

ACKNOWLEDGEMENTS

Authors would like to thanks to Dr. Ranjakumar TC, professor and head, department of ophthalmology for his valuable guidance.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Khwala Abu Samra. The eye and visual system in pregnant eye. What to expect? An in-depth review. *Oman J Ophthalmol.* 2013;6:87-91.
2. Gotovac M, Kastelan S, Lukenda A. Eye and Pregnancy. *Coll Antropol.* 2013;37 Suppl 1:189-93.
3. Qureshi IA. Intraocular pressure: association with menstrual cycle, pregnancy and menopause in apparently healthy women. *Chin J Physiol.* 1995;38(4):229-34.
4. Qureshi IA, Xi XR, Wu XD. Intraocular pressure trends in pregnancy and in the third trimester hypertensive patients. *Acta Obstet Gynecol Scand.* 1996;75(9):816-9.
5. Qureshi IA, Xi XR, Wu XD, Pasha N, Huang YB. Effect of the third trimester of pregnancy on the diurnal variation of ocular pressure. *Chin Med Sci J.* 1997;12(4):240-3.
6. Green K, Phillips CI, Cheeks L. The aqueous humor flow rate and intraocular pressure during and after pregnancy. *Ophthalmic Research.* 1988; 20(6):353-7.
7. Sunness JS. The pregnant woman's eye. *Surv. Ophthalmol.* 1998;32:219-38.
8. Toris CB, Camras CB, Yablonski ME, Brubaker RF. Effects of exogenous prostaglandins on aqueous humor dynamics and bloodaqueous barrier function. *Survey of Ophthalmology.* 1997;41(2):S69-75.
9. Vitale BF, Nuzzi R, Pea A. The eye and pregnancy. *Minerva Ginecol.* 1991;43(4):141-67.
10. Ziai N, Org SJ, Khan AR, Brubaker RF. Beta-human chorionic gonadotrophin, progesterone and aqueous dynamics during pregnancy. *Arch Ophthalmol.* 1994;112(6):801-6.
11. Razeghinejad MR, Tania Tai TY. Pregnancy and glaucoma. *Surv Ophthalmol.* 2011;56(4):324-35.
12. Denis D, Touvron G. Glaucoma management during pregnancy. *J Fr Ophtalmol.* 2010;33(5):34
13. Qureshi IA, Xi XR, Yaqob T. The ocular hypotensive effect of late pregnancy is higher in multigravidae than in primigravidae. *Graefes Arch Clin Exp Ophthalmol.* 2000;238(1):64-7.
14. Saylik M, Salik SA. Not only pregnancy but also number of fetuses in uterus affects intraocular pressure. *Indian J Ophthalmol.* 2014;62:680-2
15. Congdon NG, Broman AT, Bandeen-Roche K, Grover D, Quigley HA. Central corneal thickness and corneal hysteresis associated with glaucoma damage. *Am J Ophthalmol.* 2006;141(5):868-75.

Cite this article as: Sundaram L, Swaminathan S, Ranjakumar TC, Ashraf R. Intraocular pressure variation in pregnancy: a prospective study. *Int J Reprod Contracept Obstet Gynecol* 2016;5:1406-9.