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Ocular hypotensive effect of late pregnancy with and without high blood pressure

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SUMMARY The mean ocular tension of third trimester hypertensive pregnant women did not differ significantly from that of third trimester non-hypertensives, in contrast to the tendency for open-angle glaucoma to be associated with vascular hypertension. Presumably there are different causes for the two types of vascular hypertension. The ocular hypotensive effect of late pregnancy (third trimester) was confirmed.

A significant tendency has been observed for patients with chronic simple glaucoma to have a relatively high blood pressure (compared with non-glaucomatous patients), and for ocular tension to be positively correlated with blood pressure in a group of patients with chronic simple glaucoma and low tension glaucoma.[1] Ocular hypertension is associated with high blood pressure.[2,3]

Ocular tension in pregnancy has been studied occasionally in the past but very seldom in recent years.[4–11] A lower pressure seems to be found consistently in late pregnancy, possibly due to an improved facility of outflow as judged by tonography in the few cases studied.[10,12] No previous study has compared pregnant women with high blood pressure and those without.

Accordingly we have investigated whether the high blood pressure found in late pregnancy might affect the known ocular hypotensive effect of the later months of pregnancy.

Materials and methods

Patients in the first and third trimester of pregnancy were chosen from those attending 'routine antenatal outpatient clinics at the Simpson Memorial Maternity Pavilion. Control patients (25) were obtained in a gynaecological ward. Most (11) were admitted the same morning for minor operations to be done the following day, for example, tubal ligation. Three were ambulatory patients with medical conditions such as salpingitis. Two patients were examined on the day after a 'dilatation and curettage'. None was taking oral contraceptives. The age range of the gynaecological patients was restricted to correspond with that of the pregnant patients. All patients were examined between 1000 and 1230 hours. The eye investigation was done at least 10 minutes after the antenatal examination.

The slightly uneven numbers in the various groups was the result of the availability of patients who agreed to join in the study during its period of about six months.

Eye examination was done for each patient, and included skiascopy and subjective testing. Patients with refractive errors of more than ±1·25 D were excluded, lest the known tendency for high pressure to be associated with myopia and low pressure with hypermetropia might bias the results.[13] This accounted for two exclusions from the control group, one from the first trimester group, three from the third trimester normotensives, and one from the third trimester hypertensives.

Ocular tensions were measured by one observer with a hand-held Perkins applanation tonometer. Brachial blood pressure was measured with a calibrated sphygmomanometer with the patient in the sitting position. The same observer made these measurements. To avoid observer bias on blood pressure, ocular tension was 'frozen' uninspected on the tonometer and left unrecorded until after blood pressure was taken. Inadvertent bias in applanation tonometry is avoided because the end point is assessed while the scale is outside the observer's field of vision, and has to be read subsequently.

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Table 1 *Measurement of ocular tension in three pregnant groups and non-pregnant controls*

Group	Numbers	Median age in years (range)	Diastolic BP in mmHg	Ocular tension (applanation)	
				Mean	SD
(a) Non-pregnant normotensive control	25	27 (19–34)	≤85	14·8*	1·7
(b) First trimester normotensive	20	26 (20–35)	≤85	14·1*	2·6
(c) Third trimester normotensive	33	25 (17–38)	≤85	12·1†	1·7
(d) Third trimester hypertensive	19	28 (21–42)	>85	12·4†	2·2

Groups with mean ocular tensions marked * showed a significant difference from those marked †:
(*a*) vs (c), $t=5{\cdot}99$, df=56, $p<0{\cdot}005$.
(*a*) vs (d), $t=3{\cdot}94$, df=42, $p<0{\cdot}005$.
(*b*) vs (c), $t=3{\cdot}07$, df=51, $p<0{\cdot}005$.
(*b*) vs (d), $t=2{\cdot}21$, df=37, $p<0{\cdot}05$.
The difference between each group marked * and each group marked † was not significant. 95% confidence interval for mean difference in ocular tension between normotensives: (*a*) non-pregnant versus (*b*) first trimester is (−0·6, 2·0) and third-trimester: (*c*) normotensive versus (*d*) hypertensive is (−1·5, 0·9).

Randomisation. Only the first tonometrised eyes were included in the analysis, except for a few first eyes excluded by refractive error, in which case second examined eyes were included. Simple randomisation was used to determine for each patient whether the right or left eye was examined first.

Results

Results are presented in Table 1. The mean ocular tension of the non-pregnant normotensive controls did not differ significantly from that of the first trimester normotensive pregnant women, but both were significantly greater than the mean ocular tension of the third trimester normotensives and of the third trimester hypertensives. The very small difference between the mean ocular tension of these last two groups was not significant.

Discussion

The reasons for the relatively low ocular tension found in late pregnancy in both hypertensives and normotensives are speculative but worth detailed consideration. (To prescribe late pregnancy for the treatment of open-angle glaucoma is less facetious than might appear.) Progesterone seems the likeliest effector, as suggested by Becker and Friedenwald,[10] but an effect by relaxin on a background of oestrogen and progesterone is a possibility.[12] Some evidence that systemic administration of progesterone and oestrogen/progesterone combinations causes a fall in ocular tension has been recorded,[10 12 14–16] although controversy exists.[17 18]

Some of progesterone's pharmacological properties might be steroid related with steroid blockade as a possible explanation. Accordingly we made a preliminary trial of progesterone eye drops in three patients. The results have been negative, but that does not invalidate the suggestion that peripheral steroid blockade might be a mechanism of action of progesterone on ocular tension—if indeed that is the relevant active principle of late pregnancy. Recent observations,[19] however, have shown evidence of the ocular hypotensive effect on normal rabbits of eye drops containing a steroid blocker.

A possible fallacy exists in the claim for an ocular hypotensive effect of late pregnancy. It could be that the physiological softening of ligaments in late pregnancy might extend to that of the corneoscleral envelope to produce reduced corneoscleral rigidity and therefore only an apparent fall in intraocular pressure. (However, evidence has been presented previously to support the view that the concept of (corneo-) scleral rigidity should be largely, if not completely, replaced by variations in ocular volume or, more accurately, variations in surface area of the corneoscleral envelope.[20]) Alternatively, improved uveoscleral outflow, which results from the hormonal changes of late pregnancy, is a more likely explanation for a true fall in pressure.

A comment has been made[11] that the relative ocular hypotension in late pregnancy is probably not due to reduced episcleral venous pressure.

Our finding of very similar ocular tension in hypertensive and non-hypertensive groups of third trimester pregnant women contrasts with the association between vascular hypertension and open-angle glaucoma in elderly patients found in a previous study.[1] The discrepancy is probably due to the presumed difference in aetiology between the two hypertensions, but difference in age may be important. Many other possible explanations exist.

A study of non-pregnant non-hypertensives and a cohort of pregnant women followed up from the first trimester would have been a better theoretical protocol than the present cross-sectional one. It was not adopted mainly because of the impossibility of being able to predict what proportion of the pregnant women would have developed hypertension in the last trimester.

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