ORIGINAL ARTICLE

Hypertensive Retinopathy and Visual Outcome in Hypertensive Disorders in Pregnancy

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SUMMARY

The aim of this study was to determine the prevalence of hypertensive retinopathy, features of hypertensive retinopathy and visual outcome in hypertensive disorders in pregnancy in Hospital Universiti Sains Malaysia, Kelantan, Malaysia. A prospective observational hospital based study involving 154 patients (308 eyes) with hypertensive disorders in pregnancy was conducted. All subjects were examined once during antenatal period, at a minimum of 35 weeks of gestation for blood pressure, visual acuity and funduscopy. The similar protocol was repeated at six weeks postnatal period. Thirty-two point five percent had hypertensive retinopathy. Ninety eight percent had visual acuity 6/6 during antenatal assessment, while 100.00% gained 6/6 at postnatal period. Generalized arteriolar narrowing was the most common retinopathy observed. There was no statistically significant association between presence of hypertensive retinopathy and maternal age, presenting visual acuity, systolic/diastolic blood pressure (p>0.05). We conclude that prevalence of hypertensive retinopathy is 32.5%, and majority had good visual acuity during antenatal and postnatal period. Hypertensive retinopathy is insignificantly associated with maternal age, presenting visual acuity and blood pressure.

KEY WORDS:
Hypertensive retinopathy, Visual outcome, Hypertensive disorders in pregnancy

INTRODUCTION

Hypertensive disorder in pregnancy is the major concern of public health issue world wide and affects 5-10% of all pregnancies. It is a common obstetric problem contributing to maternal deaths. In Malaysia, maternal death from associated medical problem accounted for 20.6%, followed by post partum haemorrhage (19.1%), hypertensive disorders in pregnancy (14.1%) and obstetric embolism (13.9%)[1]. Other significant causes include obstetric trauma, unspecific complication of pregnancy and puerperium, and puerperal sepsis.

Hypertensive disorders in pregnancy affect both mother and fetus. Eye can be affected by the disease and requires serious attention from the managing team of obstetricians and ophthalmologists. There were numerous case reports illustrated visual threatening conditions in patients with preeclampsia and eclampsia. These included acute ischemic optic neuropathy, macula tear, central serous retinopathy, retinal detachment, central retinal vein occlusion, retinal arteriole occlusion and choroidal ischaemia[2-7].

There is a limited available data regarding hypertensive retinopathy among pregnant mothers with hypertensive disorders. Published literatures were mainly confined to retinopathy observed during pre-eclampsia and eclampsia crisis[8-10]. This study is designed to evaluate at a wider spectrum of hypertensive disorders in pregnancy and retinopathy changes. We aimed to determine the prevalence of hypertensive retinopathy, with emphasis on visual acuity and retinopathy features at 35 weeks antenatal period till delivery, and at six weeks postnatal period. Associations between hypertensive retinopathy during antenatal period with maternal age, presenting visual acuity and blood pressure were also studied.

MATERIALS AND METHODS

This prospective observational study was conducted between June 2008 till May 2010 at Ophthalmology Clinic, Antenatal Clinic and Obstetric Ward of Hospital Universiti Sains Malaysia, Kelantan, Malaysia. The study protocol was approved by the Research and Ethical Committee, School of Medical Sciences, Universiti Sains Malaysia, and written consents were obtained from all the patients.

Those who fulfilled the diagnosis of hypertensive disorders in pregnancy were included into this study. Patients were excluded if they had co-existing diabetes mellitus, patients with underlying ocular co-morbidity e.g. glaucoma, cataract, corneal opacities, history of ocular trauma or ocular surgery and previous laser treatment. Sample size was calculated using single proportion formula, based on 9.8% prevalence of hypertensive disorders in pregnancy, with 95% confidence interval[11].

Clinical evaluations were performed twice, that included a minimum of 35 weeks of gestation till delivery and at six weeks postnatal period. All patients with clinical diagnosis of hypertensive disorders in pregnancy were recruited by an independent obstetrician. A complete ocular history and

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detailed examination that included presenting visual acuity, anterior segment examination by slit lamp biomicroscopy, intraocular pressure measurement by applanation tonometer or tonopen, and posterior segment examination with indirect ophthalmoscopy were performed in all patients by another investigator who was blinded types of hypertensive disorders. A well dilated funduscopy examination was performed in all patients. Fundus photographs were reviewed by another masked investigator.

The hypertensive retinopathy was graded according to the Keith-Wagner and Barker classification[12]. Repeat evaluation of the similar protocol was performed at six weeks postnatal period by the previous identified investigators. The patients were examined at the Ophthalmology Clinic, Hospital Universiti Sains Malaysia, Kelantan, Malaysia as outpatient or inward basis for those who were medically stable. For the medically unstable patients who were admitted for blood pressure stabilization or induced delivery, they were examined at the respective wards.

Patient's blood pressure was recorded before ocular examination was carried out during each phase of evaluation. All the relevant data with examination findings were recorded in separate data collection forms for both during antenatal and postnatal period. If a patient did not turn up for postnatal assessment at six weeks, she would be notified by phone calls and reminders. Failure to do so after 2 weeks of reminders, the patient would be considered disqualified from the study.

The data collected were analyzed using Statistical Package for Social Science (SPSS) software version 12.0.1. Data was further analyzed using statistical test of Chi-Square to determine the association between retinopathy during antenatal period and maternal age, presenting visual acuity and level of recorded blood pressure. The p-value of < 0.05 was considered statistically significant.

RESULTS

A total of 204 participants were recruited into this study. Among them, 50 patients were excluded because they defaulted repeat assessment at six weeks postnatal period. Therefore, total 154 patients with 308 eyes participated and completed this study. Patients' demographic data included age, ethnicity, type of hypertensive disorders in pregnancy and period of gestation are shown in Table I.

The antenatal and postnatal visual acuity in patients with hypertensive disorders in pregnancy is summarized in Table II. In 154 eyes examined, we observed that 50 eyes (32.5%) had retinopathy changes while the remaining 104 eyes (67.5%) displayed no retinopathy during the antenatal assessment.

The retinopathy features were further classified based on Keith-Wagner and Barker classification and this is shown in Table III. Table IV illustrates retinopathy observed in all types of hypertensive disorders in pregnancy during antenatal assessment. Table V displays the association between the hypertensive retinopathy during antenatal period and maternal age, presenting visual acuity and level of recorded blood pressure. Table VI shows distribution of hypertensive retinopathy according to classification and level of systolic/diastolic blood pressure recorded during antenatal assessment.

Table I: shows demographic data

Parameters	Gestational Hypertension n (%)	Chronic Hypertension n (%)	Preeclampsia/ Eclampsia n (%)	Chronic HPT with superimposed PE/Eclampsia n (%)
Number of patients	78 (50.65)	43 (27.90)	28 (18.20)	5 (3.25)
Maternal Age (years)				
<20	2 (2.56)	1 (2.33)	4 (14.29)	0 (0.00)
21-30	4 (43.59)	7 (16.28)	8 (28.57)	2 (40.00)
31-40	33 (42.31)	24 (55.81)	15 (53.57)	2 (40.00)
41-50	9 (11.54)	11 (25.58)	1 (3.57)	1 (20.00)
Ethnicity				
Malay	75 (96.15)	42 (97.67)	28 (100.00)	5 (100.00)
Siamese	2 (2.56)	0 (0.00)	0 (0.00)	0 (0.00)
Chinese	0 (0.00)	1 (2.33)	0 (0.00)	0 (0.00)
Indian	1 (1.29)	0 (0.00)	0 (0.00)	0 (0.00)
Gestational Weeks				
35-36	16 (20.52)	20 (46.51)	13 (46.42)	4 (80.00)
37-38	31 (39.74)	16 (37.21)	11 (39.29)	0 (0.00)
39-40	31 (39.74)	7 (16.28)	4 (14.29)	1 (20.00)
41-42	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Number of Pregnancies				
Primigravida	30 (38.46)	3 (6.98)	11 (39.29)	0 (0.00)
Gravida 2-5	33 (42.31)	21 (48.84)	13 (46.42)	3 (60.00)
Gravida 6 and above	15 (19.23)	19 (44.18)	4 (14.29)	2 (40.00)

Table II: shows antenatal and postnatal visual acuity in all types of hypertensive disorders in pregnancy

Visual acuity	Gestational Hypertension n = 78 (%)				Chronic Hypertension n = 43 (%)				Preeclampsia/Eclampsia n =28 (%)				Chronic HPT with superimposed PE/Eclampsia n =5 (%)			
	Antenatal		Postnatal		Antenatal		Postnatal		Antenatal		Postnatal		Antenatal		Postnatal	
	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE
6/6	75 (96.2)	77 (98.7)	78 (100.0)	78 (100.0)	40 (93.0)	40 (93.0)	43 (100.0)	43 (100.0)	28 (100.0)	28 (100.0)	28 (100.0)	28 (100.0)	5 (100.0)	5 (100.0)	5 (100.0)	5 (100.0)
6/9	3 (3.8)	1 (1.3)	0 (0.0)	0 (0.0)	3 (7.0)	3 (7.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
6/12 to 6/60	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
*Worse than 6/60	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

* Worse than 6/60 refers to counting finger, hand movement, perception of light and no perception of light

Table III: shows antenatal and postnatal hypertensive retinopathy changes in the right eye according to Keith-Wagner-Barker classification

Hypertensive Retinopathy	Hypertensive Retinopathy n = 78 (%)		Chronic Hypertension n = 43 (%)		Preeclampsia/Eclampsia n =28 (%)		Chronic HPT with superimposed PE/Eclampsia n =5 (%)	
	Antenatal	Postnatal	Antenatal	Postnatal	Antenatal	Postnatal	Antenatal	Postnatal
No retinopathy	58 (74.4)	58 (74.4)	21 (48.9)	21 (48.9)	22 (78.5)	23 (82.1)	3 (60.0)	3 (60.0)
Presence of retinopathy								
Group 1	12 (15.4)	13 (16.7)	8 (18.6)	10 (23.2)	3 (10.7)	5 (17.9)	1 (20.0)	2 (40.0)
Group 2	8 (10.2)	7 (8.9)	12 (27.9)	11 (25.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)
Group 3	0 (0.0)	0 (0.0)	2 (4.6)	1 (2.3)	1 (3.6)	0 (0.0)	1 (20.0)	0 (0.0)
Group 4	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)

Table IV: shows specific retinopathy changes during antenatal assessment according to hypertensive disorders in pregnancy

Retinopathy changes	Gestational Hypertension n = 78 (%)		Chronic Hypertension n = 43 (%)		Preeclampsia/Eclampsia n = 28 (%)		Chronic HPT with superimposed PE/Eclampsia n = 5 (%)	
	RE	LE	RE	LE	RE	LE	RE	LE
Normal	58 (74.4)	58 (74.4)	21 (48.9)	21 (51.2)	21 (78.5)	21 (74.9)	3 (60.0)	3 (60.0)
Focal narrowing	2 (2.6)	3 (1.2)	1 (2.3)	2 (4.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Generalized narrowing	12 (15.4)	13 (16.8)	9 (20.9)	8 (18.7)	5 (17.9)	6 (21.5)	2 (40.0)	1 (20.0)
AV nipping	5 (6.4)	5 (6.4)	6 (14.1)	6 (11.7)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)
Silver wiring	0 (0.0)	0 (0.0)	1 (2.3)	1 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Focal narrowing with AV nipping	0 (0.0)	0 (0.0)	2 (4.6)	2 (4.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Generalized narrowing with AV nipping	1 (1.2)	1 (1.2)	3 (6.9)	3 (6.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Generalized narrowing with haemorrhage	0 (0.0)	0 (0.0)	1 (2.3)	1 (2.3)	1 (3.6)	1 (3.6)	0 (0.0)	1 (20.0)
Generalized narrowing with CWS	0 (0.0)	0 (0.0)	1 (2.3)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)
Serous retinal detachment	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)

Table V: shows association of retinopathy features during antenatal period with age, visual acuity and blood pressure

Variables		Retinopathy RE		*p-value	Retinopathy LE		*p-value
		Present n=50 (%)	Absent n=104 (%)		Present n=50 (%)	Absent n=104 (%)	
Age (years)							
< 20		2 (4.0)	5 (4.7)	0.057	3 (6.0)	4 (3.8)	0.057
21 - 30		10 (20.0)	41 (39.3)		10 (20.0)	41 (39.4)	
31 - 40		27 (54.0)	47 (45.5)		26 (52.0)	48 (46.2)	
41 – 50		11 (22.0)	11 (10.5)		11 (10.5)	11 (22.0)	
Visual acuity							
6/6		45 (90.0)	103 (99.0)	0.070	47 (94.0)	103 (99.0)	0.066
6/9		5 (10.0)	1 (1.0)		3 (6.0)	1 (10.0)	
Blood pressure (mmHg)							
Systolic							
Normal	< 120	0 (0.0)	0 (0.0)	0.625	0 (0.0)	0 (0.0)	0.880
Pre-hypertension	120 - 139	12 (24.0)	25 (24.0)		12 (24.0)	25 (24.0)	
Hypertension							
Stage 1	140 - 159	31 (62.0)	58 (55.8)		30 (60.0)	59 (56.7)	
Stage 2	≥ 160	7 (14.0)	21 (20.2)		8 (16.0)	20 (19.3)	
Diastolic							
Normal	< 80	1 (2.0)	2 (2.0)	0.431	1 (2.0)	2 (2.0)	0.431
Pre-hypertension	80 - 89	21 (42.0)	30 (28.8)		21 (42.0)	30 (28.8)	
Hypertension							
Stage 1	90 - 99	21 (42.0)	56 (53.8)		21 (42.0)	56 (53.8)	
Stage 2	≥ 100	7 (14.0)	16 (15.4)		7 (14.0)	16 (15.4)	

*p-value < 0.05 (Chi-Square test)

Table VI: shows distribution of hypertensive retinopathy retinopathy (based on Keith-Wagner and Barker Classification) according to level of systolic and diastolic blood pressure during antenatal assessment

Blood pressure (mmHg)		Hypertensive retinopathy				
		No retinopathy n=104 (%)	Group 1 n=25 (%)	Group 2 n=21(%)	Group 2 n=4 (%)	Group 4 n=1 (%)
Systolic						
Normal	< 120	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Prehypertension	120 - 139	25 (24.0)	5 (20.0)	6 (28.6)	0 (0.0)	0 (0.0)
Hypertension						
Stage 1	140 - 159	58 (55.8)	15 (60.0)	14 (66.7)	2 (50.0)	0 (0.0)
Stage 2	≥ 160	21 (20.2)	5 (20.0)	1 (4.7)	2 (50.0)	1 (100.0)
Diastolic						
Normal	< 80	2 (2.0)	1 (4.0)	0 (0.0)	0 (0.0)	0 (0.0)
Prehypertension	80 - 89	30 (28.8)	7 (28.0)	13 (61.9)	0 (0.0)	0 (0.0)
Hypertension						
Stage 1	90 - 99	56 (53.8)	14 (56.0)	6 (28.6)	1 (25.0)	0 (0.0)
Stage 2	≥ 100	16 (15.4)	3 (12.0)	2 (9.5)	3 (75.0)	1 (100.0)

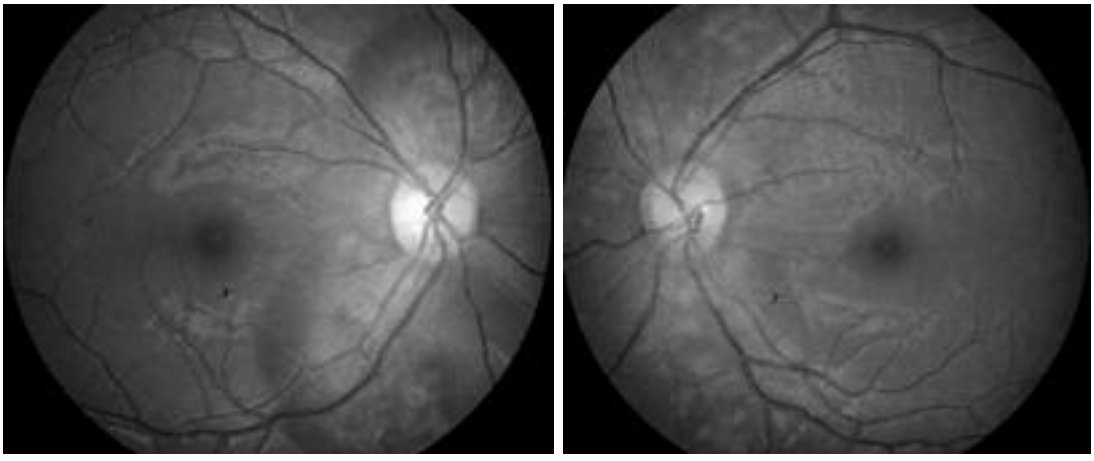

Fig. 1: Fundus photographs show resolving serous retinal detachment in both eyes with multiple patches of choroidal ischaemia.

DISCUSSION

Hypertensive disorders in pregnancy is divided into chronic hypertension, gestational hypertension, preeclampsia/eclampsia and chronic hypertension with superimposed preeclampsia/eclampsia. The eyes are rarely examined in hypertensive disorders in pregnancy unless complications like severe pre-eclampsia or eclampsia are seen.

We decided to examine these patients at 35 weeks of antenatal period till delivery as a large number of our patients presented during late third trimester with various complications related to hypertensive disorders in pregnancy. Majority of our patients had gestational hypertension (50.65%), followed by chronic hypertension (27.90%), preeclampsia/eclampsia (18.20%), and chronic hypertension with superimposed preeclampsia/eclampsia (3.25%).

Visual acuity 6/6 in both eyes during antenatal period was observed in 96.7% of our patients, while the remaining 3.3% had visual acuity 6/9. All our patients gained 6/6 during postnatal follow up. There was no patient with visual acuity of 6/12 and worse during both assessment periods. We encountered a patient with preeclampsia developed bilateral serous retinal detachment with choroidal ischaemia (Figure 1). Surprisingly, her presenting visual acuity was 6/6 in both eyes during the crisis. Her blood pressure was 165/117 mmHg. Her postnatal visual acuity remained 6/6 with blood pressure 150mmHg systolic and 90mmHg diastolic. At six weeks postnatal evaluation, the serous retinal detachment resolved leaving behind patches of retinal pigment epithelial changes.

The prevalence rate of hypertensive retinopathy in patients with hypertensive disorders in pregnancy is 32.5% in our institution. Generalized arteriolar narrowing was the most common retinal finding observed in both eyes. Other signs include arteriovenous nipping, silver wiring, focal arteriolar narrowing, retinal haemorrhages, cotton wool spots and serous retinal detachment. Our findings support the pre-existing data on funduscopy signs of hypertensive disorders in pregnancy[13-14]. However we did not encounter other retinal signs such as hard exudates, papilloedema, central serous retinopathy, central and branch retinal vein or artery occlusion, anterior ischemic optic neuropathy and maculopathy both during antenatal and postnatal assessment.

Fifty patients (100 eyes) with hypertensive retinopathy during antenatal assessment were further classified based on Keith-Wagner and Barker classification. Among these, 24 patients (48.0%) had group 1 hypertensive retinopathy, 21 patients (42.0%) displayed group 2, four patients (8.0%) showed group 3 and the least was noted in group 4 retinopathy which contributed to 2.0% (1 patient) during antenatal assessment. The trend was fairly similar during postnatal period in patients with group 1 and 2 hypertensive retinopathy in all types of hypertensive patients, except for preeclampsia/eclampsia group.

In preeclampsia/eclampsia group, three patients (10.7%) had group 1 retinopathy, one patient (3.6%) showed group 2, one patient (3.6%) displayed group 3 and another one patient (3.6%) had group 4 hypertensive retinopathy during antenatal assessment. As expected, they displayed clinical improvement during postnatal assessment, accounting for five patients (17.9%) had group 1, no patient showed signs of group 2 retinopathy and above, while another one patient had a complete regression of retinopathy. Interestingly, we observed patients with gestational hypertension and chronic hypertension had persistent retinopathy changes at six weeks postnatal evaluation. Thus, this suggests a clear need to monitor these patients' eyes at a longer follow up period.

Our above data contradicted Tadin *et al*[9]. They reported 45% ophthalmologically verified hypertensive retinopathy among 40 analyzed patients with preeclampsia/eclampsia, compared to 21.5% in our study. They concluded 55.6% group 1, 33.5% group 2 and 11.1% group 3 based on Keith-Wagner and Barker classification system.

According to the seventh report of Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure[15], 57.8% of our patient had systolic hypertension of stage 1, 18.2% had stage 2 hypertension and 24.0% belonged to pre-hypertension group. The similar pattern of diastolic blood pressure was also observed among our patients.

We observed insignificant association between presence of hypertensive retinopathy and maternal age, presenting visual acuity and level of systolic/diastolic pressure (p-value > 0.05). However, we did not assess this association in specific type of hypertensive disorders. Our data contradicted Tadin et al as they found a significant correlation between degree of hypertensive retinopathy and severity of preeclampsia[9].

Our data supports the pre-existing published reports[10,16-17]. Kaliaperumal *et al* reported level of systolic and diastolic blood pressure in mild and severe pre-eclampsia were insignificantly correlated with the retinopathy[10]. van Den Born *et al* stated a low association between hypertensive retinopathy and blood pressure in adult hypertensive patients[16]. Gupta *et al* concluded the severity of retinopathy might be independent of systemic blood pressure[17]. However, the last two studies were conducted in adult hypertensive populations and were not among pregnant mothers[16-17].

Our main limitation is due to a large patient drop out of nearly 25%. Those who defaulted had technical reasons, though they were contacted via phones. Fortunately, they belonged to group without retinopathy changes during the antenatal examination. Thus, it is unlikely for them to display significant changes during postnatal review that may affect the study outcome. Secondly, this is a hospital-based study which might have its own limitation. A population-based study will perhaps reflect the true clinical picture of this entity.

CONCLUSION

We conclude that, majority of our patients with hypertensive disorders in pregnancy had good visual acuity during antenatal and postnatal period. Thirty-two point five percent of pregnant mothers with hypertensive disorders had related retinopathy.

Group 1 and 2 hypertensive retinopathy was noted in all types of hypertensive disorders in pregnancy during antenatal period. Group 3 and 4 in preeclampsia/eclampsia group resolved to a lesser degree, while the retinopathy changes persisted during six weeks postnatal evaluation in patients with gestational hypertension and chronic hypertension. There was insignificant association between presence of hypertensive retinopathy with maternal age, presenting visual acuity and level of systolic/diastolic blood pressure.

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