Obstetric and neonatal outcome following chronic hypertension in pregnancy among different ethnic groups

C. LYDAKIS, D.G. BEEVERS, M. BEEVERS and G.Y.H. LIP

From the University Department of Medicine, City Hospital, Birmingham, UK

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Summary

We retrospectively studied pre-eclampsia rate and obstetric outcome in a cohort of 436 pregnancies amongst 318 women of different ethnic backgrounds attending an antenatal hypertension clinic from 1980–1997, identifying 152 women (213 pregnancies) with chronic essential hypertension. The ethnic breakdown was: White, 64 (30.0%) pregnancies in 48 (31.5%) women; Black/Afro-Caribbean, 79 (37.1%) pregnancies in 56 (36.8%) women; and Indo-Asians, 70 (32.3%) pregnancies in 48 (31.6%) women. The prevalences of pre-eclampsia in White, Black and Indo-Asian women were 17.2%, 12.7% and 18.6%, respectively ($p=0.58$). Pregnancies of Indo-Asian women were of shorter gestation, and babies in this group also had lower birth weight and ponderal index compared to those of White and Black women (all $p<0.05$). The proportions of overall perinatal mortality were 1.6% for Whites (1/64), 3.8% for Blacks (3/79) and 10.0% for Indo-Asians (7/70), suggesting increased risk in the Indo-Asian group. Indo-Asian women with chronic essential hypertension need careful antenatal care and observation during pregnancy.

Introduction

Ethnicity is one of many factors affecting obstetric and neonatal outcome following normal pregnancy. For example, birth weight, gestational age, rate of complications and the health of the mother and child after delivery have been related to ethnic origin. Genetic and environmental factors, such as diet, use of tobacco or drugs, religion, cultural attitudes and migration, are some of the many factors accounting for the observed differences among the ethnic groups.

Hypertensive disorders in pregnancy, including those with chronic hypertension, occur in approximately 6–7% of pregnancies and are major determinants of adverse maternal and foetal outcome. Chronic hypertension per se is associated with 0.5–3% of all pregnancies and pre-eclampsia and eclampsia, the most severe forms of hypertensive disorders in pregnancy, have been shown to be the second leading cause of maternal death in the US. Women with severe chronic hypertension or those with superimposed PE are considered to be at very high risk.

It is well-recognized that there are ethnic differences in cardiovascular disease, with an increased prevalence of coronary artery disease amongst Indo-Asians and an excess of hypertension and its complications amongst Black/Afro-Caribbean people. There is however limited information on pre-eclampsia and obstetric outcome amongst the different ethnic groups in Britain. One study suggested that Black women with chronic hypertension have a higher rate of superimposed pre-eclampsia when compared to White hypertensive women. In addition, perinatal mortality has been reported to be either equal or higher in Black women with chronic hypertension when compared to women from other ethnic groups. There is relatively limited information on women of Indo-Asian origin, but it has been observed that the mean birth weight in pregnancies of Hindu Indo-Asian women is lower when
compared to that of White women. Nevertheless, information on the impact of hypertension on Indo-Asian pregnancies is generally scarce.

The aim of the present study was to investigate the differences in prevalence of pre-eclampsia and several indices of obstetric outcome in pregnancies of chronic essential hypertensive women from a multiracial population attending an antenatal hypertension clinic.

Methods

City Hospital is a city centre general hospital in Birmingham, UK, where the ethnic mix in the adult hospital catchment population of approximately 300,000 is 69% White, 11% Black/Afro-Caribbean and 25% Indo-Asian. A retrospective cohort study from a computerized database of 436 pregnancies in 318 women attending the Antenatal Hypertension Clinic at City Hospital between 1980 and June, 1997 was performed. Pregnant women were referred to this clinic either due to previous chronic hypertension, or increased blood pressure (BP) or pre-eclampsia during a previous pregnancy, or because of high BP readings in the first weeks of pregnancy measured by their general practitioner or obstetrician. All women were followed up jointly by an obstetrician and a physician with an interest in hypertension. Information on demographic data, BP measurements, biochemical investigation, drug therapies, complications and pregnancy outcomes were recorded in the database.

A specific protocol was followed when measuring the BP. The woman was seated in a quiet room, with the arm supported and an appropriate cuff (relative to arm circumference) was used. BP was measured by a random-zero sphygmomanometer on at least two occasions over a period of no less than 3 min, in keeping with the International Society of Hypertension (ISH) guidelines. The first and fifth Korotkoff sounds were recorded for systolic and diastolic BPs, respectively. Classification of hypertensive disorders was performed according to the criteria by Davey and MacGillivray and endorsed by the International Society for the Study of Hypertension in Pregnancy (ISSHP) (Table 1). Antihypertensive treatment was usually introduced if DBP exceeded 100 mmHg.

From the initial cohort, 213 pregnancies occurred in 152 women with chronic hypertension and were included in the present analysis. Pregnancies in women with diabetes, renal diseases, secondary forms of hypertension, or with duration of gestation of less than 20 weeks were excluded. Maternal data used in the present analysis included ethnicity, age, initial body mass index (BMI), past medical history (including history of hypertension and pre-eclampsia in previous pregnancies), duration of gestation, delivery mode and use of antihypertensive drugs. Infant clinical data similarly included were birth weight, birth length, stillbirth (defined as intrauterine death with an Apgar score 0 at 1 min after >24 weeks of gestation) and early neonatal death (occurring between 1st and 7th post delivery day). Intrauterine growth retardation was evaluated by the recently updated weight-for-gestation normograms (after correction for baby gender), which have corrected the previously published standards that underestimated birth weight in infants of <32 weeks’ gestation. Growth retardation was also assessed by calculating the ponderal index, calculated as weight (kg)/length (m)3 × 104, which is independent of gestational age and has been proposed as a better measure of intrauterine growth than birth-weight percentiles. Finally, the outcome of pregnancies from women with uncomplicated hypertension were compared with the total general obstetric population of our hospital for the year 1994 (3516 births).

Continuous variables are presented as means (standard deviation) and categorical variables as percentages. Data were analysed in a personal computer using the STATISTICA software package. Continuous variables were tested for normality of frequency distribution. High skewness and kurtosis in the frequency distribution of ponderal index were found and therefore logarithmic transformation was performed to enable the use of parametric tests. Statistical tests performed included the χ2 test, ANOVA and MANOVA (for multiple covariates). For continuous variables amongst the three ethnic groups (Whites, Blacks and Indo-Asian) when an ANOVA test was significant, a Tukey HSD test was used to identify the specific groups between which the differences were significant; with the latter procedure, the statistical software package did not give the absolute p value, but statistical significance was expressed as ‘p<0.05’. The relative risks (RR) and their 95% CIs were calculated. A two-tailed p value <0.05 was considered as statistically significant.

Results

The ethnic groups of the cohort of 213 pregnancies in 152 women are summarized as follows: (i) Whites 64 (30.0%) pregnancies in 48 (31.5%) women; (ii) Black/Afro-Caribbeans 79 (37.1%) pregnancies in 56 (36.8%) women; and (iii) Indo-Asians 70 (32.3%) pregnancies in 48 (31.6%) women.

The maternal characteristics among the 3 different ethnic groups are summarized in Table 2. Although Indo-Asian women who were multigravidae had a significantly higher number of previous pregnancies...
when compared with other ethnic groups, there were no differences in the number of previous miscarriages and pre-eclampsia in previous pregnancies between the ethnic groups. There was a non-significant trend towards a higher proportion of primigravidae and a lower proportion of antihypertensive drug use amongst White pregnant women when compared with pregnancies of Black and Indo-Asian women. None of the Indo-Asian women were smokers (Table 2).

**Pre-eclampsia**

The prevalence of pre-eclampsia rates for the different ethnic groups were 17.2% (11/64) in Whites, 12.7% (10/79) in Blacks and 18.6% (13/70) in Indo-Asians ($\chi^2 = 10.6, p = 0.58$). Amongst primigravidae, a trend towards a lower prevalence of pre-eclampsia was noted in Whites (1/16, 6.2%) when compared to Blacks (4/9, 44.4%) and Indo-Asians (4/9, 44.4%), although the small numbers would not allow for reliable statistical testing.

**Maternal characteristics and neonatal outcome**

Indo-Asian women had significantly shorter pregnancies when compared with White women. There was also a non-significant trend towards a higher proportion of pre-term deliveries (<37 weeks) in the Indo-Asian women. The proportion of women undergoing emergency caesarean section did not differ among the groups. The mean blood pressures recorded before 20 weeks, between 20 and 30 weeks and from 30 weeks to delivery, did not significantly differ between the three ethnic groups (Table 3).

Babies of Indo-Asian women had significantly lower weight and ponderal index values, when compared to Whites and Blacks (ANOVA, both $p < 0.05$). This difference remained significant after correction for maternal age, initial body mass index, gravity, baby sex and administration of antihypertensive drugs during pregnancy (MANOVA, $p < 0.05$).

There was a higher proportion of babies who were small for their gestational age (defined as weight below the 10th percentile; $p = 0.04$) and low-birth-weight babies (defined as $<3$ kg; $p = 0.02$) in pregnancies of Indo-Asian when compared to White and Black women. The proportion of stillbirths and overall perinatal mortality (that is, ‘stillbirths’ plus ‘early neonatal mortality’, from birth to 7th post-delivery day) was highest in the Indo-Asian women; this ethnic group sustained 70% (7 of 10 total deaths) of the perinatal mortality observed in the whole study cohort (Table 4).

**Comparison with general hospital obstetric population**

All three ethnic groups in the present study had an increased risk for emergency caesarean section and low birth weights, whether defined as $<2$ kg or as $<3$ kg, compared to the general hospital obstetric population ($n = 3516$ births in 1994) (Table 5). There was a higher risk of stillbirth for the pregnancies of Indo-Asian hypertensive women, when compared with pregnancies from Indo-Asian women from the general obstetric population: RR (95% CI) 9.4 (33.7–23.8). The relative risks for White and Black women did not appear to be substantially increased, although statistical tests were inappropriate due to the small numbers. By contrast, the prevalence of stillbirth was similar amongst the three ethnic groups in the general hospital obstetric population (Table 5).

**Discussion**

Although the prevalence of pre-eclampsia did not differ between the ethnic groups, pregnancies of
Indo-Asian women were found to have more adverse outcomes, including lower mean birth weight and ponderal index values, and higher proportions of SGA babies and stillbirths. The present study represents one of the largest series reporting the outcome of pregnancies in the 1990s amongst a multiethnic population of women with chronic essential hypertension in Britain. Limitations include its retrospective nature, although we are confident that we have included every case prospectively into our computerized database. We accept that obstetric care may have changed over 17 years of our database, but the triethnic mix of our hospital catchment population would not have altered significantly over that period; thus our data would be a composite of women seen over that period. Some data, such as stillbirths and perinatal mortality, have small absolute numbers, making statistical comparisons and definitive conclusions difficult. Some women may also have been erroneously labelled as chronic essential hypertension, although we took great care to exclude women with secondary causes of hypertension. The application of birth weight-for-gestational-age criteria based upon Caucasian populations should however be regarded with some caution, since they may not be appropriate for different ethnic groups. The same may also be true for the use of ponderal index as a measure of intrauterine retardation. Not all Indo-Asian populations may be similar, with potential differences between different subgroups of Indo-Asians, but those in the catchment population of our hospital are predominantly from the Punjab area, with only a small proportion from Bangladesh. Previous studies addressing ethnic differences in pregnancy have been conducted in the general population, and have particularly studied differences in pre-eclampsia, birth weight, or stillbirth. Fewer studies have been conducted in chronic hypertensive gravidae, but these have provided some data. By contrast, a study based on an American military population did not note such ethnic differences, although this may also be true for the use of ponderal index as a measure of intrauterine retardation. Not all Indo-Asian populations may be similar, with potential differences between different subgroups of Indo-Asians, but those in the catchment population of our hospital are predominantly from the Punjab area, with only a small proportion from Bangladesh. Anova between groups (1) and (2).

### Table 2 Maternal characteristics

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>N</th>
<th>Mean ± SD (years)</th>
<th>BMI mean ± SD</th>
<th>Primigravidae n (%)</th>
<th>Proportion with ≥ 2 previous pregnancies n (%)</th>
<th>PE in previous pregnancy n (%)</th>
<th>Smoking n (%)</th>
<th>Duration of gestation mean ± SD (weeks)</th>
<th>Delivery &lt; 37 weeks n (%)</th>
<th>Administration of drugs n (%)</th>
<th>Emergency caesarean n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>64</td>
<td>31.1 ± 5.6</td>
<td>27.9 ± 7.0</td>
<td>16 (25.0)</td>
<td>13 (27.1)</td>
<td>5 (10.4)</td>
<td></td>
<td>37.6 ± 3.5</td>
<td>16 (25.0)</td>
<td>44 (68.7)</td>
<td>12 (18.8)</td>
</tr>
<tr>
<td>Black</td>
<td>79</td>
<td>31.4 ± 5.3</td>
<td>27.7 ± 5.7</td>
<td>9 (11.4)</td>
<td>33 (41.9)</td>
<td>17 (21.6)</td>
<td></td>
<td>36.6 ± 3.4</td>
<td>26 (32.9)</td>
<td>55 (70.8)</td>
<td>63 (65.9)</td>
</tr>
<tr>
<td>Indo-Asian</td>
<td>70</td>
<td>31.1 ± 5.1</td>
<td>26.9 ± 5.1</td>
<td>9 (12.9)</td>
<td>39 (56.4)</td>
<td>15 (21.4)</td>
<td></td>
<td>35.9 ± 3.4</td>
<td>29 (41.4)</td>
<td>60 (85.7)</td>
<td>21 (30.0)</td>
</tr>
</tbody>
</table>

BMI, body mass index; PE, pre-eclampsia. *Among multi-gravidae.
Table 3  Mean blood pressures during pregnancy among ethnic groups

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Mean BP &lt;20th week (mmHg) mean (SD)</th>
<th>Mean BP 20th–30th week (mmHg) mean (SD)</th>
<th>Mean BP &gt;30th week (mmHg) mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>107.1 (8.8)</td>
<td>102.0 (7.0)</td>
<td>105.7 (8.1)</td>
</tr>
<tr>
<td>Black</td>
<td>103.1 (11.4)</td>
<td>100.3 (12.0)</td>
<td>102.8 (12.2)</td>
</tr>
<tr>
<td>Indo-Asian</td>
<td>104.5 (10.3)</td>
<td>101.3 (9.9)</td>
<td>104.2 (9.1)</td>
</tr>
</tbody>
</table>

No statistical differences were found between groups during the three periods.

weights were recorded in Europeans and White Americans.30 Indian babies born in the UK have also been reported to be lighter than White European babies25,31 and Indo-Asian women have a relatively shorter pregnancy duration.14 Whilst differences in birth weight exist between Hindu Indo-Asians and White Europeans, this is not apparent when Moslem Indo-Asians and White Europeans in the UK are compared.15 Perinatal mortality in Indo-Asians has also been reported either as equal25 or higher14 when compared with pregnancies of White women. Babies of Black women also tend to be lighter and have a higher stillbirth risk, with an OR of 1.6 (95% CI 1.1–2.3) when compared to the general population.27 Nevertheless, there is still a relative paucity of previous data comparing ethnic differences in obstetric outcome amongst White, Black and Indo-Asian pregnant women with chronic essential hypertension from a similar cohort, as in the present study. Indeed, we are unaware of other similar comparisons in the literature of a tri-ethnic population, and our finding of an adverse pregnancy outcome amongst Indo-Asians may account for the (non-significant) trend towards higher pre-eclampsia in previous pregnancies in this ethnic group. One observation however is that Indo-Asians in the UK include many Muslims with first-cousin marriages, possibly leading to more congenital defects associated with consanguinity.33,34

In a 1984 study of 337 pregnancies of 298 pregnant women with chronic hypertension, pre-eclampsia was significantly more common in Blacks when compared to White women (36.4% vs. 16.5%, p < 0.001).15 In addition, prematurity and perinatal mortality rates were higher in Blacks when compared with White women with chronic hypertension (32.4% vs. 19.4% and 9.5% vs. 2.9% respectively).14 By contrast, a retrospective analysis of 384 548 births in an American general population reported that the adjusted risk for stillbirth in chronic hypertensive subjects tended to be greater in Whites when compared to Black pregnant women, in both primi- and multigravidae.13 A further retrospective analysis in 289 125 pregnancies from the same general population reported that Black women with chronic hypertension were at significantly higher risk for small-for-gestational-age babies (OR 1.7, 95%CI 1.4–1.9), low birth weight (defined as <2.5 kg) (OR 1.9, 95% CI 1.6–2.2) and pre-term delivery (<37 weeks) (OR 1.2, 95% CI 1.1–1.4).3

The Black women in the present study originate from a population emigrating from the West Indies to UK in the 1950s and early 1960s, whereas Indo-Asian women originate from a population immigrating from several parts of Indian subcontinent, particularly the Punjab and north India, in the late 1960s and 1970s.32 As a result of this migration pattern, more Indo-Asian women in Birmingham would be expected to be first-generation migrants, whereas most West Indian mothers would be second-generation migrants. This may be relevant, since cultural and religious factors, which tend to lose their importance in second and third generation immigrants, may influence the obstetric outcome.1 Dietary and cultural factors and also poor use of health services in Indo-Asians may also play a role for the worse outcome observed in this group. Other factors that may possibly play a role in determining obstetric outcome amongst the different ethnic groups include dietary habits35 and socio-economic level.36 For example, Indo-Asian women tend to have a lower intake of zinc, vitamins D and B6, magnesium and sodium.37 Smoking habit is also an important factor, since it is related with small birth weight and intrauterine growth retardation38 but protects against the development of pre-eclampsia.35 However, Indo-Asian mothers in the present series were non-smokers. The differences observed between the three ethnic groups of women with chronic essential hypertension in the present study could not therefore be simply explained by demographic factors, socio-economic status,34 smoking status or severity of hypertension.

Conclusions
We suggest that the obstetric and neonatal outcomes in women with chronic essential hypertension differs amongst different ethnic groups. Although the prevalence of pre-eclampsia was not different amongst pregnancies of White, Black and Indo-Asian women, the latter group had shorter gestations, babies of lower birth weight and ponderal index values, and
Table 4  Neonatal outcome in Whites, Blacks and Indo-Asians

<table>
<thead>
<tr>
<th>Pregnancies</th>
<th>n</th>
<th>Baby sex (male)</th>
<th>Baby weight (g)</th>
<th>Baby length (cm)</th>
<th>Ponderal weight index (kg/m^3 × 10^4)</th>
<th>Log ponderal index</th>
<th>SGA n (%)</th>
<th>Weight &lt;2 kg n (%)</th>
<th>Weight &lt;3 kg n (%)</th>
<th>Stillbirths* n (%)</th>
<th>Overall perinatal mortality* n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>64</td>
<td>36 (56.2)</td>
<td>2706 (865)</td>
<td>48.6 (6.0)</td>
<td>23.1</td>
<td>1.36 (0.06)</td>
<td>23 (35.9)</td>
<td>11 (17.2)</td>
<td>35 (54.7)</td>
<td>1 (1.6)</td>
<td>1 (1.6)</td>
</tr>
<tr>
<td>Black</td>
<td>79</td>
<td>40 (50.6)</td>
<td>2564 (821)</td>
<td>47.9 (4.3)</td>
<td>22.9</td>
<td>1.37 (0.06)</td>
<td>29 (36.7)</td>
<td>18 (22.8)</td>
<td>54 (68.3)</td>
<td>3 (3.8)</td>
<td>3 (3.8)</td>
</tr>
<tr>
<td>Indo-Asian</td>
<td>70</td>
<td>37 (53.0)</td>
<td>2243 (741)</td>
<td>47.0 (4.7)</td>
<td>22.4</td>
<td>1.34 (0.07)</td>
<td>38 (54.3)</td>
<td>24 (34.3)</td>
<td>58 (82.9)</td>
<td>6 (8.6)</td>
<td>7 (10.0)</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

χ^2 = 0.5
p = 0.76

ANOVA between groups (1) and (2)

SGA: Small-for-gestation-age (<10th percentile). *Stillbirth and perinatal mortality data have small absolute numbers, thus statistical comparisons not performed.

Table 5  Relative risks in hypertensive women compared to the general obstetric hospital population (n=3516 in 1994)

<table>
<thead>
<tr>
<th>Pregnancies</th>
<th>Emergency caesarean*</th>
<th>Birth weight &lt;2 kg</th>
<th>Birth weight &lt;3 kg</th>
<th>Stillbirth</th>
</tr>
</thead>
<tbody>
<tr>
<td>White hypertensives</td>
<td>12/64 (18.8%)</td>
<td>11/64 (17.2%)</td>
<td>35/64 (54.7%)</td>
<td>1 (1.6%)</td>
</tr>
<tr>
<td>Whites from hospital population</td>
<td>139/1427 (11.2%)</td>
<td>88/1446 (6.1%)</td>
<td>432/1446 (29.9%)</td>
<td>14/1446 (1.0%)</td>
</tr>
<tr>
<td>RR (95% CI)</td>
<td>1.9 (1.1–3.3)</td>
<td>2.8 (1.6–5.0)</td>
<td>1.6 (1.2–2.0)</td>
<td>**</td>
</tr>
<tr>
<td>Black hypertensives</td>
<td>21/79 (26.6%)</td>
<td>18/79 (22.8%)</td>
<td>54/79 (68.3%)</td>
<td>3/79 (3.8%)</td>
</tr>
<tr>
<td>Blacks from general population</td>
<td>57/511 (10.7%)</td>
<td>44/533 (8.2%)</td>
<td>207/533 (38.8%)</td>
<td>8/533 (1.5%)</td>
</tr>
<tr>
<td>RR (95% CI)</td>
<td>2.4 (1.5–3.7)</td>
<td>2.8 (1.7–4.5)</td>
<td>1.8 (1.5–2.1)</td>
<td>**</td>
</tr>
<tr>
<td>Indo-Asian hypertensives</td>
<td>21/70 (30.0%)</td>
<td>24/70 (34.3%)</td>
<td>58/70 (82.9%)</td>
<td>6/70 (8.6%)</td>
</tr>
<tr>
<td>Indo-Asian from hospital population</td>
<td>134/1509 (8.7%)</td>
<td>94/1537 (6.1%)</td>
<td>593/1537 (44.7%)</td>
<td>14/1537 (0.9%)</td>
</tr>
<tr>
<td>RR (95% CI)</td>
<td>3.4 (2.3–5.0)</td>
<td>5.6 (3.8–8.2)</td>
<td>2.1 (1.9–2.4)</td>
<td>9.4 (3.7–23.8)</td>
</tr>
</tbody>
</table>

RR, relative risk. *Data available in 3447 pregnancies. **Small samples, thus statistical comparisons unreliable.
a higher proportion of stillbirth. These differences were irrespective of demographic or clinical factors, and suggest that further investigation into social, cultural and life style diversities among the three ethnic groups is needed to explain some of our observations. Women with chronic essential hypertension amongst the Indo-Asian ethnic group need careful antenatal care and observation during pregnancy.

Acknowledgements
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