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Arterial Blood Pressure - The Pattern of Change in Twin Pregnancies

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Abstract. An epidemiological study of all primigravid twin pregnancies delivered in Aberdeen between 1950 and 1969 was performed to determine the pattern of arterial blood pressure changes. There is a greater fall from non-pregnant levels in diastolic blood pressure by mid pregnancy and a greater rise of diastolic pressure by delivery. These changes are independent of age, body size and rate of weight gain during pregnancy. The expected increased incidence of proteinuric pre-eclampsia is also independent of rate of weight gain when defined for twin pregnancies.

Key words: Blood pressure, Twin pregnancy, Pre-eclampsia

INTRODUCTION

The pattern of blood pressure in normal singleton pregnancy has been well documented. In the 1969 survey of MacGillivray et al [5] blood pressure is low at 12 weeks and does not begin to rise until about 30 weeks gestation. The postpartum value found, however, was higher than the readings during pregnancy and it is assumed that this is the same as the prepregnant value in these women and that, therefore, there must be a fall in blood pressure in early pregnancy. This change is most marked in diastolic blood pressure, and is thought to be due to decreased peripheral resistance, possibly due to a circulating vasodilator substance, perhaps either progesterone or one of the prostaglandins. It is postulated that in twin pregnancies with an exaggerated response to pregnancy there might be more vasodilator substance present, ie, more hormone output from the fetoplacental unit leading to a greater drop in peripheral resistance and, therefore, lower internal blood pressure. While this may happen early in gestation, it is known that there is a marked increase in the incidence of hypertension and proteinuria in twin pregnancies, approximately 29% as compared to 5.8% in singletons [3].

METHODS

The casenotes of all primigravid twin pregnancies between 1950 and 1969 occurring

at Aberdeen Maternity Hospital were reviewed and the relevant data extracted. The data were then analysed in a manner similar to that of MacGillivray (1961) whose singleton data from Aberdeen [4] have been used throughout for comparison.

RESULTS

The results from the two *total* populations, namely, twin pregnancies and singleton pregnancies, are compared. The frequency of occurrence of diastolic blood pressure at mid pregnancy, namely, 20 weeks, is shown in Table 1. It is seen that there are more women with twins with lower diastolic blood pressures: overall, 74.3% of primigravidae with a twin pregnancy have a diastolic blood pressure less than 80 mmHg compared with only 66% of singletons. This difference is statistically significant ($P < 0.02$). There is, however, no difference in the frequency of systolic blood pressure at 20 weeks when the twin pregnancies are compared with singleton pregnancies (Table 2).

As blood pressure is known to increase with advancing age, and twin pregnancies are known to occur more frequently to older women, the diastolic blood pressure at 20 weeks of women with twin pregnancies was compared to that of singleton pregnancies for each age group (Table 3). As expected, there is a tendency for diastolic blood pressure to be higher in the older age groups, but the difference between women with twin pregnancies and singleton pregnancies remains, the former having lower diastolic blood pressures for each of the age groups studied.

As twinning is commoner in heavier women [1], and blood pressure also increases with increasing body weight, the distribution of diastolic blood pressure at 20 weeks was considered in relation to body size, dividing both the twin pregnancies and singleton pregnancies according to weight for height centiles at 20 weeks [2] (Table 4). Again, there are differences. There are fewer women with low diastolic blood pressures in the fat group as compared to the thin group, but the difference between twin pregnancies and singleton pregnancies remains for each category, thin, normal and fat.

To examine this further, the diastolic blood pressure 6 weeks postpartum was related to that at mid pregnancy, 20 weeks (Table 5). Of the women whose diastolic blood pressures postpartum lay between 70 and 79 mmHg, 77.5% had a similar or lower level during pregnancy. Considering the group with postpartum diastolic blood pressure between 80 and 89 mmHg, 64.1% had a lower diastolic blood pressure at 20 weeks, and a further third had similar levels, and in those with postpartum diastolic blood pressure over 90 mmHg, 92.9% had a lower blood pressure at mid pregnancy.

This is in contrast to the findings on diastolic blood pressure at delivery. Table 6 gives the distribution of postpartum (non-pregnant) diastolic blood pressure related to delivery levels. Almost half of the women with twin pregnancies whose diastolic blood pressure postpartum was less than 70 mmHg or between 70 and 79 mmHg, had delivery levels over 90 mmHg (47.8% and 48.8%, respectively). This suggests an exaggerated rise of blood pressure in twin pregnancies towards the end of gestation.

The rise in diastolic blood pressure between 20 weeks and delivery was related to the 20 week blood pressure (Table 7). In twin pregnancies, there were more women with a rise of diastolic blood pressure of over 15 mmHg, of those with less than 80 mmHg at 20 weeks, 67.2% compared with 38.2% of singletons, and of those with more than 80 mmHg, 27.3% compared with only 15.4% of singletons. The relationship between the rise in diastolic blood pressure and the rate of weight gain is given in Table 8. In Table 8 A weight gain between 20 and 30 weeks is defined according to singleton standards of what

Table 1. Distribution of Diastolic Blood Pressure at 20 Weeks Gestation in Primigravid Twin and Singleton Pregnancies (% rate)

Diastolic B.P. (mmHg)	< 70		70-79		80-89		≥ 90	
Twin pregnancies (171)	24.6	(42)	49.7	(85)	23.4	(40)	2.3	(4)
Singleton pregnancies (4215)	22.4	(944)	43.6	(1838)	28.4	(1197)	5.6	(236)

Nos. in brackets indicate numbers in each category.

Table 2. Distribution of Systolic Blood Pressure at 20 Weeks Gestation in Primigravid Twin and Singleton Pregnancies (% rate)

Systolic B.P. (mmHg)	< 120		120-129		130-139		≥ 140	
Twin pregnancies (171)	26.9	(46)	35.7	(61)	25.7	(44)	11.7	(20)
Singleton pregnancies (4215)	29.3	(1235)	34.2	(1568)	23.4	(986)	10.1	(426)

Nos. in brackets indicate numbers in each category.

Table 3. Distribution of Diastolic Blood Pressure at 20 Weeks Gestation in Primigravid Twin and Singleton Pregnancies by Maternal Age (% rates)

Maternal age (yr)		Diastolic B.P. (mmHg)						
		< 70	70-79	80-89	≥ 90			
< 20	Twins (23)	43.5	(10)	39.1	(9)	17.4	(4)	0
	Singletons (384)	18.8	(72)	41.1	(158)	33.1	(127)	7.0 (27)
20 - 24	Twins (75)	32.0	(24)	49.3	(37)	14.6	(11)	4.0 (3)
	Singletons (2246)	16.3	(366)	42.2	(952)	34.2	(768)	7.1 (160)
25 - 29	Twins (46)	8.7	(4)	56.5	(26)	32.6	(15)	2.2 (1)
	Singletons (1193)	15.4	(184)	44.4	(529)	33.9	(404)	6.4 (76)
≥ 30	Twins (27)	14.8	(4)	48.1	(14)	2.2	(1)	0
	Singletons (460)	8.9	(41)	40.2	(185)	6.4	(76)	11.5 (53)

Nos. in brackets indicate numbers in each category.

Table 4. Distribution of Diastolic Blood Pressure at 20 Weeks Gestation in Primigravid Twin and Singleton Pregnancies by Maternal Body Size (%)

Maternal body size		Diastolic B.P. (mmHg)							
		<70		70-79		80-89		≥90	
Thin (<25th centile weight for height)	Twins (16)	50.0	(8)	31.3	(5)	18.8	(3)	0	
	Singletons (867)	22.7	(197)	43.9	(381)	28.5	(247)	4.8	(42)
Normal (25- <75th centile weight for height)	Twins (90)	25.6	(23)	52.2	(47)	20.0	(18)	2.2	(2)
	Singletons (2382)	15.8	(377)	44.2	(1053)	33.1	(788)	6.9	(164)
Fat (≥75th centile weight for height)	Twins (52)	15.4	(8)	53.8	(28)	28.8	(15)	1.9	(1)
	Singletons (1018)	8.7	(89)	37.7	(384)	42.8	(436)	10.7	(109)

Nos. in brackets indicate numbers in each category.

Table 5. Distribution of Diastolic Blood Pressure 6 Weeks Postpartum Related to that at 20 Weeks Gestation in Twin pregnancy (%)

20 weeks D.B.P. (mmHg)	Postpartum D.B.P. (mmHg)								
	<70		70-79		80-89		≥90		Total
<70	3.1	(4)	10.8	(14)	5.4	(7)	3.1	(4)	22.3 (29)
70 - 79	9.2	(12)	23.8	(31)	13.9	(18)	3.1	(4)	50.0 (65)
80 - 89	2.3	(3)	8.5	(11)	10.0	(13)	3.8	(5)	24.6 (32)
≥90			1.5	(2)	0.8	(1)	0.8	(1)	3.1 (4)
Total	14.6	(19)	44.6	(58)	30.0	(39)	10.8	(14)	100.0 (130)

Nos. in brackets indicate numbers in each category.

Table 6. Distributions of Diastolic Blood Pressure 6 Weeks Postpartum Related to Delivery Diastolic Blood Pressure in Twin Pregnancy (%)

Delivery D.B.P. (mmHg)	Postpartum D.B.P. (mmHg)								
	<70		70-79		80-89		≥90		Total
<70	1.0	(2)	1.0	(2)	0.5	(1)			2.5 (5)
70 - 79	2.6	(5)	4.6	(9)	2.6	(5)			9.8 (19)
80 - 89	2.6	(5)	15.9	(31)	7.7	(15)	2.1	(4)	28.3 (55)
≥90	5.6	(11)	20.5	(40)	22.1	(43)	11.3	(22)	59.5 (116)
Total	11.8	(23)	42.0	(82)	32.9	(64)	13.4	(64)	100.1 (195)

Nos. in brackets indicate numbers in each category.

Table 7. Distribution of Increment of Diastolic Blood Pressure from 20 Weeks Gestation to Delivery by 20 Week Diastolic Blood Pressure Level in Primigravid Twin and Singleton Pregnancies (%)

D.B.P. 20 wk (mmHg)	D.B.P. increment (mmHg)					
	Twin pregnancies			Singleton pregnancies		
	0-4	5-14	≥ 15	0-4	5-14	≥ 15
< 80	12.8 (16)	20.0 (25)	67.2 (84)	22.6 (510)	39.2 (885)	38.2 (862)
≥ 80	38.6 (17)	34.1 (15)	27.3 (12)	55.7 (863)	28.9 (448)	15.4 (239)

Nos. in brackets indicate number in each category.

Table 8. Distribution of Increment of Diastolic Blood Pressure from 20 Weeks Gestation to Delivery by Rate of Weight Gain in Twin and Singleton Pregnancies

Weight gain (lb/week) ^a	D.B.P. increment (mmHg)					
	Twin pregnancies			Singleton pregnancies		
	0-4	5-14	≥ 15	0-4	5-14	≥ 15
A						
< 0.75	31.0 (9)	10.5 (4)	17.9 (15)	30.1 (414)	26.5 (351)	19.1 (212)
0.75 - < 1.25	13.8 (4)	23.7 (9)	16.7 (14)	50.4 (693)	50.6 (669)	49.2 (546)
≥ 1.25	55.2 (16)	65.8 (25)	65.5 (55)	19.4 (267)	23.0 (304)	31.7 (352)
B						
< 1	44.8 (13)	34.2 (13)	34.5 (29)			
1 - < 1.5	34.5 (10)	28.9 (11)	36.9 (31)			
≥ 1.5	20.7 (6)	36.8 (14)	28.6 (24)			

^a 1 lb = 454 g.

Nos. in brackets indicate numbers in each category.

Table 9. Incidence (%) of Proteinuric Pre-Eclampsia in Primigravid Twin and Singleton Pregnancies by Rate of Weight Gain

Rate of weight gain (lb/week) ^a	Twin pregnancies	Singleton pregnancies
A		
< 0.75	18.0 (7)	9.8 (23)
0.75 - < 1.25	30.8 (12)	40.6 (95)
≥ 1.25	51.3 (20)	49.6 (116)
B		
< 1.0	33.3 (13)	
1.0 - < 1.5	41.0 (16)	
≥ 1.5	25.6 (10)	

^a 1 lb = 454 g.

would be considered low, normal and high rates of weight gain. Table 8 B shows twin pregnancies when weight gain has been redefined according to our own data [1] of average rate of weight gain in twin pregnancies, giving new low, normal and high categories. The first comment is that there are many more women with pregnancies in the high weight gain category than there are singletons. A rise of diastolic blood pressure of over 15 mmHg is associated in a greater proportion in twin pregnancies of women with high weight gain (65.5% vs 31.7% of singleton pregnancies). However, when weight gain is redefined according to twin standards, those twin pregnancies with a rise of diastolic blood pressure over 15 mmHg are represented equally in the three categories of weight gain (Table 8 B). A similar pattern emerges when the incidence of proteinuric pre-eclampsia and twin pregnancies is considered in respect to weight gain (Table 9). Pre-eclampsia was defined according to Nelson (1955)[6]. First part (A) shows the incidence of proteinuric pre-eclampsia by the weight gain categories defined according to singleton standards, and 51.3% of the twin pregnancies developing proteinuric pre-eclampsia had a high rate of weight gain, ie, a similar figure to the singleton pregnancies, 49.6%. However, when the weight gain is redefined according to twin standards, only 25.6% of those with proteinuric pre-eclampsia had a high rate of weight gain for twins (Table 9 B).

DISCUSSION

Women with twin pregnancies have a lowered diastolic blood pressure at 20 weeks, which is not related to either age and body stature. This was confirmed by examining the twin pregnancies six week postpartum blood pressure levels. It is, therefore, considered that there is a bigger decrease in peripheral resistance in women expecting twins, presumably due to the increased endocrine output of the fetoplacental units.

In addition, there were more women with twin pregnancies who had a greater rise in diastolic blood pressure between mid pregnancy and delivery. This has been shown to be an overshoot above the postpartum level. This exaggerated rise in blood pressure in late pregnancy in women with twins is not associated with weight gain when that is defined according to the average response in a twin pregnancy, although there is an excess of women with a high weight gain by singleton standards in the twin group with a rise in blood pressure of 15 mmHg or more. In many countries, a rise in blood pressure of 15 mmHg in diastolic blood pressure is considered pathological. It is believed that pregnancies should be considered as having an exaggerated maternal response with greater rate of weight gain and greater changes of diastolic blood pressure between mid pregnancy and delivery. Standards, therefore, for what is defined as pathological hypertension in twin pregnancies should be reviewed in the light of these findings. Interestingly, the development of proteinuric pre-eclampsia is again not associated with an excess rate of weight in twin pregnancy.

REFERENCES

1. Campbell DM, Campbell AJ, MacGillivray I (1974): Maternal characteristics of women having twin pregnancies. *J Biosoc Sci* 6:463-470.
2. Kemsley WFF, Billewicz WZ, Thomson AM (1962): A new weight for height standard based on British Anthropometric data. *Brit J Prev Soc Med* 16:189-195.
3. MacGillivray I (1958): Some observations on the incidence of pre-eclampsia. *J Obstet Gynaecol Brit Emp* 65:536-539.

4. MacGillivray I (1961): Hypertension in pregnancy and its consequences. *J Obstet Gynaecol Brit Comwlth* 68:557-569.
5. MacGillivray I, Rose GA, Rowe D (1969): Blood pressure survey in pregnancy. *Clin Sci* 37:395-407.
6. Nelson TR (1955): A clinical study of pre-eclampsia. *J Obstet Gynaecol Brit Emp* 62:48-57.

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