Blood pressure in the first 6 weeks of life

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SUMMARY  Systolic blood pressure was measured at frequent intervals during the first 6 weeks of life in 99 normal neonates. Blood pressure rose from a mean of 70 mmHg at age 2 days, to 93 mmHg at age 6 weeks in babies awake; the majority of this rise (14 mmHg) took place in the first 2 weeks of life. The blood pressure measured when infants were asleep was lower than in those awake, but increased in a similar manner. Blood pressure of infants at 2 days was not significantly affected by method of delivery, or by the anaesthesia or analgesia that the mothers received in labour. It was not related to the Apgar score at one or five minutes.

Previous studies have shown that there is a pronounced rise in blood pressure at some time between the ages of 4 days and 6 weeks from 76 to 96 mmHg. The blood pressure then remains reasonably constant until about age 6 years. We have therefore measured the systolic blood pressure in a group of neonates at frequent intervals during the first 6 weeks of life, in order to determine the precise ages over which this increase takes place. We have also investigated the influence of maternal anaesthesia and analgesia in labour, type of delivery, and Apgar score on the infants' blood pressure at 48 hours.

Subjects and methods

We studied 99 infants born at Farnborough Hospital, Kent, after 38 weeks' gestation, whose parents lived in the London borough of Bromley and had given informed consent.

We excluded those babies whose parents did not have telephones, because of practical difficulties in arranging visits.

We also excluded low birthweight and preterm infants, and those who were ill enough to require admission to the special care baby unit. In addition, we later excluded those infants who developed any illness requiring admission to hospital during the first 6 weeks of life, and those whose mothers were given diuretics or antihypertensive drugs in pregnancy or labour.

The blood pressures were measured by trained research nurses, first in the maternity wards and then at home; all measurements were made in the morning. The blood pressure was measured in the right arm using the Parks Doppler ultrasound system, with the latex neonatal cuff which has previously been evaluated, and a random zero sphygmomanometer. Three measurements of blood pressure were made on each occasion and the means subsequently analysed. The level of consciousness of the baby was defined as either 'awake'—that is, lying quietly eyes open—or 'asleep'—that is, lying quietly eyes closed at the beginning of blood pressure measurement.

Details of delivery, Apgar scores, and drugs given to the mother during pregnancy and delivery were recorded. Weight and arm circumference and details of any intercurrent illness were recorded at each visit.

Results

The systolic blood pressure rose from a mean of 70 mmHg at age 2 days to a mean of 84 mmHg at 2 weeks in babies awake. There was a further rise of 9 mmHg to 93 mmHg by age 6 weeks. The majority of the increase—that is 14 mmHg—therefore took place in the first 2 weeks of life (Figure). The mean blood pressure of infants who were asleep when their blood pressure was measured was lower at all ages, but rose in a similar manner.

74% of those babies aged less than one week were asleep at the time of blood pressure measurement. Therefore, when investigating the possible effects of delivery and maternal drugs we subtracted 4 mmHg from the blood pressures of those babies awake, since this was the mean difference between blood pressures in babies awake and asleep at this age. Blood pressure is proportional to weight, but adjusting measurements for this did not materially affect the results.

Blood pressure may be influenced by such factors as the method of delivery or drugs given to the
The mechanism of this physiological rise in blood pressure in the neonatal period has not been determined in humans. Studies in sheep\(^7\) and dogs\(^8\) have however demonstrated that cardiac output is falling at this time paralleled with the rise in systolic pressure, implying a pronounced rise in peripheral resistance during the neonatal period. If this were the case for humans also, it would indicate that in addition to the sudden increase in peripheral vascular resistance which occurs at delivery with cord clamping and lung expansion, the total peripheral vascular resistance continues to rise during the first 6 weeks of life. A noninvasive method of measuring cardiac output is necessary to confirm this.

Woodbury et al.\(^9\) found that general anaesthesia and opiates, given to mothers in labour, had no effect on their infant's blood pressure measured during the first 10 days of life, and Holland and Young\(^10\) also showed that opiates given in labour did not affect the infant's blood pressure. These findings were confirmed in our study as infants' blood pressures were not affected significantly by pethidine administration or general anaesthesia in labour.

We found that complicated deliveries—such as, forceps, breech, and caesarean section—were not associated with a significantly different blood pressure from normal deliveries (Table), whereas Holland and Young found that babies delivered by caesarean section tended to have lower blood pressures up to age 3 weeks.\(^10\)

Holland and Young\(^10\) also found that neonatal asphyxia (defined as 'white asphyxia'), was associated with low blood pressure up to age 6 weeks. We found no correlation between low Apgar scores at one or five minutes, or the need to intubate at delivery, and blood pressure at 2 days, but 2 infants with severe birth asphyxia who had scores of less than 8 at ten minutes, both had low blood pressures at 2 and 4 days. The blood pressure of one of these infants remained low until age 4 weeks. 'White asphyxia' denotes severe birth asphyxia and it is possible that in our study only these 2 infants were asphyxiated severely enough for the blood pressure to be affected.

In conclusion, there is a very rapid rise in blood pressure in the first 2 weeks of life, perhaps associated with a pronounced rise in peripheral resistance. In nonasphyxiated babies, instrumental delivery is not associated with altered blood pressures in the neonatal period.

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**Discussion**

Previous studies have shown that blood pressure increases during the first 6 weeks of life. We have shown that the greater part of this rise occurs in the first 2 weeks of life, and that there is a further gradual increase to age 6 weeks. The blood pressure then remains relatively constant until about 6 years.

The Table shows that complicated deliveries were associated with an infant blood pressure 3 mmHg higher at 2 days than with normal deliveries, but this difference was not statistically significant, and was not present by the time that the infants were aged 4 days. The type of analgesia given in labour did not affect the blood pressure of the baby at 2 days, or later.

Apgar score at one and five minutes was not related to the blood pressure at any age, in 15 children who had scores of less than 7 at one minute, or in 3 children who had scores of less than 7 at five minutes. The 2 children who had low Apgar scores at ten minutes (that is were severely asphyxiated), had lower blood pressure at 2 days (61 mmHg and 48 mmHg), and at 4 days (59 mmHg and 49 mmHg) than the babies with scores of 10 at ten minutes (66 mmHg at 2 days and 71 mmHg at 4 days).

Table  Blood pressure at age 2 days according to the method of delivery

<table>
<thead>
<tr>
<th>Delivery</th>
<th>Blood pressure (mmHg)</th>
<th>Mean ± SEM</th>
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<tbody>
<tr>
<td>Normal (n = 56)</td>
<td>64 ± 1.1</td>
<td></td>
</tr>
<tr>
<td>All instrumental deliveries (n = 43)</td>
<td>67 ± 1.2</td>
<td></td>
</tr>
<tr>
<td>Forceps (n = 28)</td>
<td>67 ± 1.5</td>
<td></td>
</tr>
<tr>
<td>Breech (n = 5)</td>
<td>67 ± 3.4</td>
<td></td>
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<tr>
<td>Caesarean sections (n = 10)</td>
<td>68 ± 2.7</td>
<td></td>
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</tbody>
</table>

![Graph](image.png)

Figure  Increase in systolic blood pressure between ages 2 days and 6 weeks in infants awake and asleep.
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References


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