CORRELATION OF BIOCHEMICAL DATA WITH APGAR SCORES AT BIRTH AND AT ONE MINUTE

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SUMMARY

A prospective study of 66 unselected neonates revealed a better correlation of umbilical artery blood biochemical data with the Apgar score at birth compared with the score at 1 min. The data confirmed also that inclusion of the score for “colour” detracts from the value of the total score. An Apgar score at birth is more valuable than the score at 1 min.

The Apgar scoring system (Apgar, 1953) has become the universally accepted method of clinical evaluation of the newborn infant. Apgar (1966) recommended that the first score be assigned at 60 s after birth; this interval was chosen in 1952 after observing several hundred infants for the time of maximum clinical depression. However, recent reports have demonstrated that the correlation between the 1-min Apgar score and foetal blood biochemical data is not strong (Hon, Khazin and Paul, 1969; Khazin, Hon and Quilligan, 1969; Crawford, Davies and Pearson, 1973). Crawford, Davies and Pearson (1973) found that inclusion of the score for “colour” reduced the discriminatory value of the total score. We have been impressed with the fact that medical management during the first minute of life may alter markedly the clinical condition of the infant at 60 s. Therefore, we have examined the relationship between Apgar rating at birth and at 60 s after birth (inclusive and exclusive of the score for colour), and umbilical artery blood-gas and acid–base data.

METHODS

Sixty-six unselected infants were included; 21 were born by vaginal delivery and 45 by Caesarean section. Foetal heart rate abnormalities had been diagnosed in seven infants, expulsion of thick meconium occurred in four and both heart rate deceleration and evidence of meconium were noted in seven. The following methods of anaesthesia were employed: subarachnoid block with amethocaine, lumbar extradural block with chloroprocaine–bupivacaine, pudendal block with lignocaine, nitrous oxide analgesia and thiopentone–nitrous oxide–suxamethonium anaesthesia with tracheal intubation.

An anaesthesia resident (S. M. or M. N. M.), not involved in the care of the mother, assigned the “birth” Apgar score immediately following delivery of the infant’s feet (vertex presentation) or head (sacral presentation), at which moment an automatic timer was started. The observer accompanied the infant to the cot and, in conjunction with the paediatrician in attendance, assessed the “1 min” score.

The umbilical cord was clamped at two sites before the infant’s first breath. Blood was sampled separately from the umbilical vein and artery, and pH, $P_{O_2}$ and $P_{CO_2}$ were determined (Radiometer microelectrodes and Model 27 read-out). Changes in base values were calculated from the nomogram of Siggaard-Andersen and others (1960).

The general management of the newborn was undertaken by the paediatrician. Vigorous infants were treated with gentle stimulation and a flow of oxygen over the face. Infants with respiratory depression received oxygen by positive pressure, using either a face-mask or an endotracheal tube. When marked acidosis was expected, as a result of analysis of foetal scalp blood or because there was poor neonatal muscle tone, cannulation of the umbilical vein was performed immediately for the administration of sodium bicarbonate, plasmanate and glucose. Suspected aspiration of meconium was treated according to the recommendations of Gregory and others (1974) with avoidance of stimulation, exposure of the larynx and endotracheal suction.

RESULTS

Apgar scores at birth were good (8 or 9) in 33 infants fair (5–7) in 23 and poor (1–4) in 10. They remained unchanged at 60 s in only 11 infants. In 43, the 1-min score was greater (1 point in 21 infants, 2 points in 12 infants, 3 points in 10 infants) and in 12 it was
less (1 point in four infants, 2 points in one infant,
3 points in two infants, and 4—7 points in four
infants) than the score at birth. Of 11 infants with
the same birth and 1-min scores, nine had scored
9, one had scored 8 and one had a score of 1. A
decrease of three or more points in the 1-min score
as compared with the birth score resulted from
the following causes: aplastic lungs (one infant),
vagovagal reflex because of pharyngeal stimulation
(two infants) and suspected aspiration of meconium
(three infants).

Linear correlations between birth and 1-min
Apgar scores and umbilical artery blood biochemical
data are shown in table I and figures 1 and 2. At birth

<table>
<thead>
<tr>
<th>Umb. artery blood</th>
<th>Score at birth</th>
<th>Score at 1 min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incl. colour</td>
<td>Minus colour</td>
</tr>
<tr>
<td>pH</td>
<td>66</td>
<td>0.635*</td>
</tr>
<tr>
<td>Po_2</td>
<td>56</td>
<td>0.602*</td>
</tr>
<tr>
<td>PCO_2</td>
<td>56</td>
<td>-0.048</td>
</tr>
<tr>
<td>Base deficit</td>
<td>56</td>
<td>-0.594*</td>
</tr>
</tbody>
</table>

*P < 0.001.

there was a statistically significant correlation (P <
0.001) between the clinical score and blood pH,
Po_2 and base change values; the correlation coeffi-
cients for pH and Po_2 were greater when the
factor of colour was not included in the total score.
At 1 min, the correlation was significant only for pH

![Fig. 1. The relationship between umbilical artery blood
pH and the Apgar score (minus colour) at birth. The
correlation is highly significant for all 66 infants (r = 0.65;
P < 0.001) and for the 21 infants with scores below 6 (r =
0.75; P < 0.001).](https://academic.oup.com/bja/article-abstract/49/8/831/330099)

![Fig. 2. The relationship between umbilical artery blood pH
and the Apgar score (minus colour) at 1 min. For all 66
infants: r = 0.52; P < 0.01. For 17 infants with scores less
than 6: r = 0.05.](https://academic.oup.com/bja/article-abstract/49/8/831/330099)

but, again, it was increased by elimination of the
score for colour.

**DISCUSSION**

Our data demonstrate a superiority of an Apgar
score at birth over a score at 1 min. At birth, the
score is representative solely of the clinical condition
of the newly born infant while, at 1 min, it is influenced
additionally by the resuscitator’s efforts. With
current methods of neonatal resuscitation, the period
of maximum depression is no longer at 60 s after
birth because resuscitative measures may have been
instituted. Furthermore, the management of sus-
pected meconium aspiration makes the 1-min score
meaningless as this is usually the time of the first
tracheal suction.

Our results reveal a positive relationship between
foetal oxygenation and the clinical condition of the
infant at birth, thus corroborating the findings of
foetal benefit from an increased oxygen fraction in
the anaesthetic mixture inhaled by the mother
(Rorke, Davey and Du Toit, 1968; Moir, 1970;
Marx and Mateo, 1971). In contrast to the pH values,
oxygen tensions change rapidly so that at 1 min the
correlation is no longer evident.

Finally, our data confirm the observation by
Crawford, Davies and Pearson (1973) that exclusion
of the score for colour increases the correlation
between the total score and umbilical artery blood
biochemical data. Interestingly, their correlation
coefficients for pH, PCO_2 and base deficit were
similar to ours at 1 min (table II).
TABLE II. Correlation coefficients of total 1-min Apgar scores with acid-base data, as obtained in the present study and that of Crawford, Davies and Pearson (1973)

<table>
<thead>
<tr>
<th></th>
<th>Present study</th>
<th>Caesarean section (narcotic)</th>
<th>Extradural (no narcotic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>0.45</td>
<td>0.36</td>
<td>0.39</td>
</tr>
<tr>
<td>P CO₂</td>
<td>0.27</td>
<td>0.19</td>
<td>0.27</td>
</tr>
<tr>
<td>Base deficit</td>
<td>0.28</td>
<td>0.25</td>
<td>0.40</td>
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</table>

REFERENCES


CORRELATION DES DONNEES BIOCHIMIQUES ET DE L’INDICE D’APGAR AU MOMENT DE LA NAISSANCE ET UNE MINUTE APRES

RESUME

Une étude portant sur 66 nouveaux-nés pris au hasard a révélé une meilleure corrélation des données biochimiques du sang artériel ombilical et de l’indice d’Apgar au moment de la naissance qu’avec la cotation à une minute. Les données ont également confirmé que l’inclusion de la cotation pour la “couleur” amoindrit la valeur de la cotation totale. L’indice d’Apgar au moment de la naissance est beaucoup plus valable que la cotation à une minute.

KORRELATION BIOCHEMISCHER UND APGAR-DATEN BEI DER GEBURT UND NACH EINER MINUTE

ZUSAMMENFASSUNG


CORRELACION DE LOS DATOS BIOQUIMICOS CON LA VALORACION DE APGAR AL NACER Y TRANSCURRIDO UN MINUTO

SUMARIO

Un estudio prospectivo de 66 neonatos no seleccionados reveló una mejor correlación de datos bioquímicos de sangre arterial umbilical con la valoración de Apgar al nacer, que con la valoración o tanteo a 1 min. Los datos confirmaron igualmente que la inclusión del tanteo para el "color" afecta adversamente el valor del tanteo total. Una valoración de Apgar al nacer es más valiosa que el tanteo a 1 min.