

# The Newborn (Apgar) Scoring System

## *Reflections and Advice*

VIRGINIA APGAR, M.D.

Almost two decades ago the need was felt for a way to judge the condition of a newborn baby quickly and accurately shortly after birth. In 1949 the criteria in use were "breathing time" and "crying time." As a result of the frequent use of heavy medication during labor and of general anesthesia for delivery, an initial gasp, a period of apnea and finally established respiration were common. Should "breathing time" be recorded as the first gasp, or respiration which followed the period of apnea? Also, infants who had undergone more than usual birth asphyxia, or who had anomalies of the central nervous system, often did not cry at all. What, then, was the crying time?

Between 1949 and 1952 several signs easily observed in the newborn were considered. Five were chosen which could be evaluated without special equipment and could be taught to the delivery room personnel without difficulty.

The original intention of establishing a scoring system was to predict survival, to compare several methods of resuscitation which were in use at the time, and through the infant's responsiveness after delivery, to compare perinatal experience in different hospitals. The influence of various obstetrical practices such as induction of labor, elective cesarean section and maternal anesthesia and analgesia might well be reflected in the score. It was furthermore hoped that the scoring system would ensure closer observation of the infant during the first minute of life. The value of the system for neonatal research and for predicting neuromuscular deficit in early childhood was demonstrated later.

The system is working well in identifying infants who have severe metabolic imbalance. It is not working well as a baseline for future follow-up studies. There are two reasons for this inadequacy.

1. After receiving reports from many hospitals and visiting many personally, experience has demonstrated that the person delivering the infant should *not* be the one to assign the score. He or she is invariably emotionally involved with the outcome of the delivery and

**Table 1.** *The Collaborative Study on Cerebral Palsy, Mental Retardation and Other Neurologic and Sensory Disorders of Infancy and Childhood*

| ONE-MINUTE APGAR SCORES<br>27,176 SINGLE BIRTHS |       |      |      |      |      |      |      |      |      |      |      |      |      |
|---|-------|------|------|------|------|------|------|------|------|------|------|------|------|
| SCORE   | TOTAL | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| 0   | 0.1   | 0.1  | 0.2  | 0.3  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.4  | 0.1  | 0.0  | 0.0  |
| 1   | 1.8   | 2.3  | 0.9  | 0.8  | 2.2  | 2.1  | 1.6  | 0.9  | 1.2  | 1.8  | 1.8  | 4.6  | 0.6  |
| 2   | 2.0   | 2.2  | 1.7  | 2.4  | 3.2  | 1.8  | 2.0  | 1.6  | 1.4  | 2.1  | 2.1  | 2.1  | 1.0  |
| 3   | 2.2   | 2.8  | 2.5  | 1.9  | 2.4  | 1.8  | 1.6  | 1.0  | 2.3  | 2.1  | 2.3  | 2.3  | 1.6  |
| 4   | 2.8   | 3.2  | 3.4  | 1.8  | 3.6  | 2.1  | 2.8  | 1.9  | 2.7  | 3.3  | 2.7  | 3.5  | 1.8  |
| 5   | 4.5   | 5.0  | 4.3  | 3.9  | 7.4  | 4.6  | 5.1  | 4.5  | 3.7  | 5.4  | 3.6  | 7.0  | 2.3  |
| 6   | 6.5   | 7.1  | 6.3  | 8.3  | 8.9  | 6.2  | 5.6  | 6.7  | 6.1  | 8.3  | 5.3  | 7.0  | 4.2  |
| 7   | 8.7   | 8.6  | 15.8 | 5.1  | 16.7 | 8.1  | 5.5  | 10.9 | 7.1  | 12.3 | 8.9  | 7.4  | 4.6  |
| 8   | 20.8  | 27.2 | 34.9 | 6.8  | 33.9 | 16.9 | 10.4 | 27.3 | 14.8 | 20.8 | 21.3 | 12.8 | 11.2 |
| 9   | 40.5  | 40.0 | 28.6 | 46.2 | 18.5 | 34.9 | 45.8 | 40.9 | 41.5 | 35.1 | 47.8 | 46.9 | 41.6 |
| 10  | 8.2   | 1.3  | 1.1  | 21.8 | 2.9  | 4.0  | 19.4 | 0.6  | 19.2 | 3.8  | 4.1  | 6.5  | 31.1 |

| FIVE-MINUTE APGAR SCORES<br>27,176 SINGLE BIRTHS |       |      |      |      |      |      |      |      |      |      |      |      |      |
|--|-------|------|------|------|------|------|------|------|------|------|------|------|------|
| SCORE  | TOTAL | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| 0  | 0.0   | 0.0  | 0.0  | 0.0  | 0.1  | 0.0  | 0.0  | 0.1  | 0.1  | 0.1  | 0.0  | 0.0  | 0.0  |
| 1  | 0.6   | 0.5  | 0.5  | 0.2  | 0.0  | 0.9  | 0.6  | 0.4  | 0.5  | 1.4  | 0.7  | 1.7  | 0.4  |
| 2  | 0.5   | 0.4  | 0.2  | 0.9  | 0.1  | 0.3  | 0.6  | 0.5  | 0.2  | 1.0  | 0.7  | 1.2  | 0.2  |
| 3  | 0.6   | 0.6  | 0.5  | 0.6  | 0.5  | 0.9  | 0.5  | 0.2  | 0.2  | 0.5  | 0.7  | 1.0  | 0.4  |
| 4  | 0.6   | 0.5  | 0.2  | 0.7  | 0.5  | 1.0  | 0.8  | 0.3  | 0.8  | 0.5  | 0.8  | 0.7  | 0.5  |
| 5  | 0.9   | 0.7  | 0.6  | 0.9  | 2.2  | 1.5  | 0.5  | 0.4  | 0.8  | 1.4  | 0.9  | 2.5  | 0.8  |
| 6  | 1.7   | 1.3  | 1.4  | 2.6  | 2.7  | 2.4  | 1.1  | 0.9  | 1.6  | 2.8  | 1.8  | 3.0  | 1.4  |
| 7  | 2.5   | 2.8  | 2.8  | 2.0  | 3.6  | 3.2  | 1.4  | 3.0  | 1.7  | 4.2  | 2.5  | 3.2  | 0.9  |
| 8  | 8.3   | 10.1 | 11.2 | 2.3  | 20.7 | 9.7  | 2.2  | 8.7  | 3.8  | 8.5  | 9.7  | 2.7  | 2.8  |
| 9  | 54.3  | 76.8 | 68.6 | 41.4 | 39.7 | 61.9 | 17.5 | 74.4 | 13.1 | 61.0 | 51.5 | 56.6 | 34.2 |
| 10   | 29.7  | 6.3  | 14.1 | 48.4 | 29.6 | 17.7 | 74.7 | 10.5 | 77.2 | 18.1 | 30.8 | 27.3 | 58.4 |

with the family, and cannot or unconsciously does not make an accurate decision as to the total score. I know of no reliable study which compared scores given by various delivery room personnel, but my impression is strong that obstetricians give higher scores than anesthesiologists, nurse anesthetists, pediatricians or delivery room nurses. A number have claimed "never to have had a baby with a score less than 5." The data from Finland<sup>1</sup> in Figure 2 show an incidence of score 10 in 83 per cent of births! These scores were assigned by the midwife delivering the baby.

In 27,176 infants who are part of the Collaborative Study for Neuro-muscular Deficit being conducted by the National Institute of Neurological Diseases and Blindness of the National Institutes of Health,<sup>7</sup> score 10 ranged from 0.6 to 31.1 per cent in 13 hospitals. In almost all cases specially trained personnel, not the obstetrician, decided on the score (Table 1).

It is ideal to have a specially trained observer, whether physician or nurse, but this happy situation is seldom practical. Until such time when a pediatrically oriented person is routinely present for all deliveries, the anesthesiologist or anesthetist is in a good position to assign the score, especially if the infant is placed in a bassinet near the head of the delivery table. With regional anesthesia he is entirely free to make the necessary observations, and with general anesthesia the mother should be nearly awake or at least light enough so that protective reflexes have returned.

More and more the ability and accuracy of observations of the circulating nurse are coming to be appreciated. She usually has considerably more experience with delivery room crises and discipline than an intern or resident and is often the only other person present in addition to the obstetrician. Her services should be encouraged. The only drawback is her multiplicity of duties at the time of delivery. This leads to the second point which needs clarification.

2. The time to assign the score was and still is 60 seconds after birth. This interval was chosen in 1952 after observing several hundred infants for the time of maximum clinical depression. Thirty-, 60-, 90- and 120-second observations were made with two observers, who agreed that 60 seconds after both the top of the head and bottoms of the feet were visible was the time to apply the score.<sup>2</sup> Serial measurements of the infant's arterial acid-base state during the first minutes of life show that maximal acidosis is present several minutes later than 60 seconds.<sup>5</sup> The importance of the one-minute score cannot be overestimated, however, from the point of view of assisted ventilation.

There should be some automatic way to announce the passage of 60 seconds. Only clinicians in anesthesia have learned to live by the second hand of a watch. To others, a minute is an unbelievably short interval. On some occasions, such as cardiac arrest, it is a very long interval. A simple automatic timer should be firmly fixed on the wall, set for 60 seconds. Fifty-five seconds would be preferable, for observation of the five signs should take no longer than five seconds. A one-minute timer is less expensive, however, and more available (e.g. from General Electric Company).

When the head and feet of the infant are both visible, the timer is started and can be forgotten until the alarm sounds, whereupon the score is assigned. The circulating nurse can add this brief chore to her list of duties without difficulty. This method has worked well in several hospitals.

One misconception has arisen which is easy to correct. In some clinics no active resuscitation is done until after the score has been assigned at one minute. This is, of course, wrong. It has been demonstrated that pH can drop from 7.4 to 6.9 in less than five minutes.<sup>5</sup> Time is of great importance in preventing or reversing such a sharp change. With infants known to be suffering from unusual asphyxia due to such complications as prolapse of the cord, impacted shoulders or a large breech presentation, resuscitation should begin just as soon as a free airway has been assured. Saling's<sup>8</sup> intrapartum method of sampling scalp blood should aid greatly in identifying such babies. The first score is decided at 60 seconds, even though resuscitation has been in progress.

The score at one minute does not reflect oxygenation itself.<sup>6, 9</sup> It is rather a reflection of acid-base status. Obviously, samples should be drawn from the umbilical artery rather than the vein, to judge the con-

dition of the infant. Umbilical venous blood reflects the state of placental exchange, not the infant's arterial blood.

Recently it has been demonstrated that the five-minute score is more predictive of survival than the one-minute score.<sup>4</sup> This is not surprising, for it is to be expected that the longer asphyxia exists, the more likely that death or permanent damage will occur. A comparison of infants with one- and five-minute readings with respect to their neurologic abnormalities at one year of age also shows significantly more predictive value of the five-minute score.<sup>7</sup> Nevertheless, if the first observation is made as late as five minutes, an appreciable number of infants will have their asphyxia untreated because of lack of an earlier observation, with subsequent higher mortality and morbidity. A study of those infants with low five-minute scores in relation to what treatment, if any, was administered would be of interest.

The distribution of scores from 12 institutions in the Collaborative Project at five minutes (Table 1) again indicates extensive differences between the various centers. These might be a reflection of differences in obstetric practice or in maternal analgesia or anesthesia among institutions; it could also be due to variations in the application of the scoring system. In comparing the details of score distribution and neonatal deaths in three institutions, Sloane Hospital for Women, University Hospital at Puerto Rico and the University Hospital at Helsinki, considerable differences are again demonstrated (Figs. 1, 2). Even within one institution there have been changes over several years (Fig. 3). Yet when the score distributions are grouped 0 to 3, 4 to 6, 7 to 10, the differences become negligible (Fig. 3, lower).

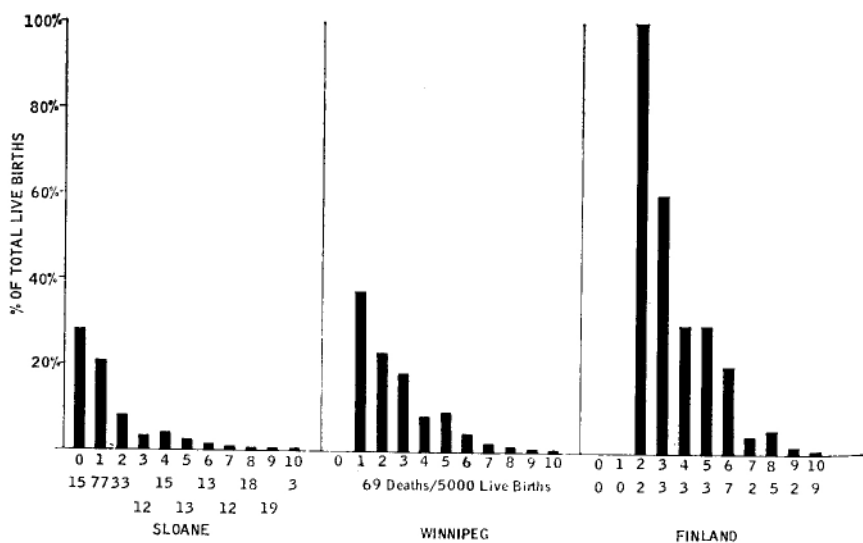


Figure 1. Neonatal deaths by score.

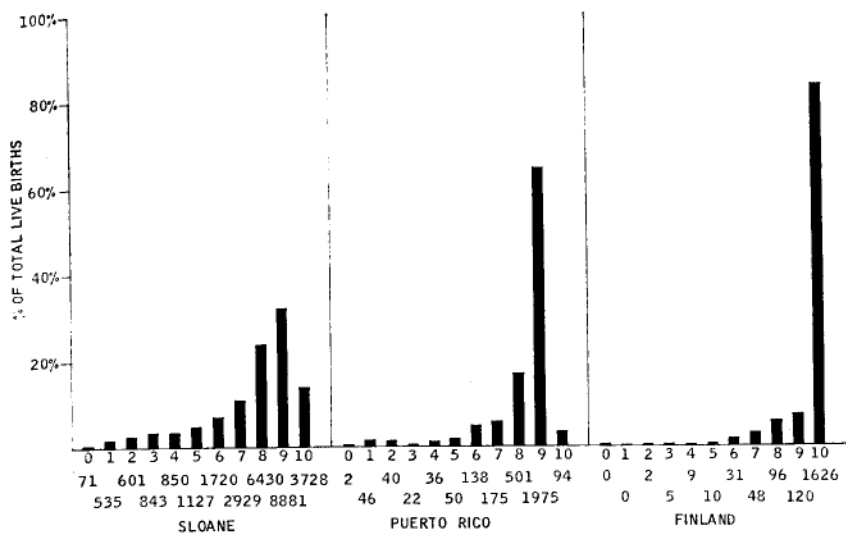


Figure 2. Distribution of scores, all births.

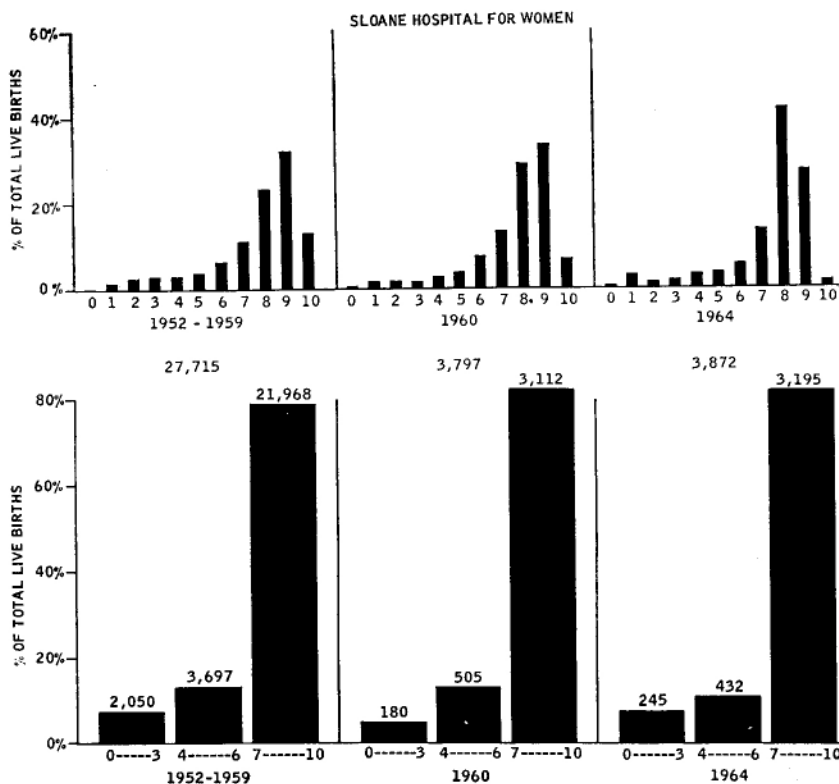


Figure 3. Variation in scores in the same hospital.

These differences might indeed be real. Nevertheless, unless interpretation of the clinical signs and the time at which the score is given are standard for all institutions, conclusions will not be valid. This becomes even more important when the scoring system is being used for correlations with subsequent neurologic development.

### SUMMARY

It is strongly advised that an observer, other than the person who delivers the infant, be the one to assign the score.

An automatic method of announcing the passing of 60 seconds is recommended.

Although mortality and the presence of significant neurologic damage correlate better with the five-minute than the one-minute score, the one-minute score should nevertheless be retained. It is essential to observe the infant from the moment of birth in order that prompt treatment can be given if necessary. Nine months' observation of the mother surely warrants one-minute observation of the baby.

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The National Foundation  
800 Second Avenue  
New York, N.Y. 10017