SCORING SYSTEMS IN NEONATAL MEDICINE AND DETECTION OF RISKS

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Abstract

Medical scores, criteria and classification systems support clinical decision-making and management. They enable the clinician to predict the outcome, stratify risk, assess conditions and diagnose diseases accurately[1]. Scoring systems involve using appropriately weighted demographic, physiological, and clinical data collected on the infant to calculate a score that quantifies its morbidity.

The most used scores in neonatal practice are:

-immediate assessment of the newborn: APGAR score and assessment of the gestational age

-morbidity scores: sepsis score, pain score, Silverman score, morbidity score, danger signs of illness, Sarnat&Sarnat classification, Finnegan score;

-prognostic scores: CRIB score, SNAP-Pe score, MAIN score, perinatal risk score and

-scores for behavior and attachment (Brazelton NBAS score).

Although there are many scoring systems and scales for detecting risks in neonates, none of them is of unique value, and still the clinicians' opinion is the leading force in assessment, treatment and prediction of the neonatal outcome. All of them should be used consciously and in accordance with other determinants of health.

Key words: newborn, morbidity, mortality, disease, hypoxic-ischaemic encephalopathy

Introduction

Medical scores, criteria and classification systems support clinical decision-making and management. They enable the clinician to predict the outcome, stratify risk, assess conditions and diagnose diseases accurately[1]. Scoring systems involve using appropriately weighted demographic, physiological, and clinical data collected on the infant to calculate a score that quantifies its morbidity. The desirable properties of neonatal scores have been described as including[2]:

-ease of use;

-applicability early in the course of hospitalisation;

-ability to reproducibly predict mortality, specific morbidities, or cost for various categories of neonates;

-usefulness for all groups of neonates to be described [3].

However, these properties are difficult, perhaps impossible, to achieve completely. Although it may be possible to derive a risk adjustment score in a particular study, investigators will often require a readymade score. They may lack the data, resources, time, funding, or expertise required to develop their own, and a previously validated score also has the advantage that it is more likely to be accepted by others.

There are various scores derived for neonates in the medical literature, and the choice of which variables are to be included in the score and their relative weights is obviously vital. A balance needs to be drawn between a complex score including many variables, and therefore difficult to complete, and a simpler model that may be easier to use but not as accurate. It also needs to be remembered that no score can completely quantify the complex factors that make up an individual infant's morbidity.

Usually, scores are created in one of two ways.

-***Medical*** scores are derived by an expert panel using clinical knowledge to select the variables to be included in the score and their relative weights.

-Alternatively, collected data are used in statistical models to produce ***statistical*** scores by identifying which variables have strong association with the outcome of interest and their relative weights.

There is evidence that, in the long run, statistical scores outperform medical scores and today most scores are statistical as there are often relevant data available. However, clinical knowledge may contribute to the choice of variables included in a final model; not just because the model is then likely to perform better with other groups of infants but because it will be seen as more reliable by users.

Whatever is the mode of score derived, it is important that it has been *validated* to confirm that it predicts future events, preferably in a different dataset, with an adequate accuracy. *Reproducibility* is also an important feature of scores. If scores are not closely reproducible, then concern must exist about the potential introduction of bias when scores are used to enable comparisons.

These scores are also used frequently for quality assessment among various neonatal care units and hospital. They also serve to control for population differences when performing studies such as clinical trials, outcome evaluations, and evaluation of resource utilisation. Although presently there are multiple scores designed for neonates' sickness assessment but none of the score is ideal. Each score has its own advantages and disadvantages along with their merits and demerits[4].

Here are some of the scoring systems used in clinical neonatal practice, overviewing advantages, disadvantages and limitations.

APGAR score- a rapid method of assessing the clinical status of the newborn

The most widely used in everyday practice is the APGAR score, scoring system used to evaluate current state of the newly born baby and his/her capacity to live out of the uterus. This scoring system comprises five components: 1) color, 2) heart rate, 3) reflexes, 4) muscle tone, and 5) respiration, each of which is given a score of 0, 1, or 2. Thus, the Apgar score quantitates clinical signs of neonatal depression such as cyanosis or pallor, bradycardia, depressed reflex response to stimulation, hypotonia, and apnea or gasping respirations,[5][6][7] however, it has been inappropriately used to predict individual adverse neurologic outcome[8]. Although the score is used widely in outcome studies, its inappropriate use has led to an erroneous definition of asphyxia. The Apgar score does not predict individual

neonatal mortality or neurologic outcome, and should not be used for that purpose.[9][10]. Limitations of Apgar score: the Apgar score is an expression of the infant's physiologic condition at one point in time, which includes subjective components. There are numerous factors that can influence the Apgar score, including maternal sedation or anesthesia, congenital malformations, gestational age, trauma, and interobserver variability. In addition, the biochemical disturbance must be significant before the score is affected. Elements of the score can be subjective, and partially depend on the physiologic maturity of the infant. There is also an expanded Apgar score which may prove to be useful in the setting of delayed cord clamping, where the time of birth, the time of cord clamping, and the time of initiation of resuscitation all can be recorded in appropriate box.[11][12]

Estimation of gestational age of the newborn

Different scoring systems based on neurological and physical examination are used in the neonatal units for assessment of gestational age. Assessment of gestational age is very much helpful in labelling the newborn to be preterm, term or post–term and to assess the further outcome of the newborn infants. There are two combined clinical systems for such a purpose, Ballard and Dubowitz scoring system [13], and few other, rarely used, as the methods of Farr, Finnstrom, Lubchenko and Parkin[14] which are based on external criteria, while those of Robinson and Amiel-Tison based on neurological criteria. Although separately neurological and physical criteria can estimate the gestational age but combining them makes the method more accurate.

The correlation for the score obtained for the total Ballard assessment is greater than that obtained by any of its individual components. Thus, the total Ballard score is more accurate, both the individual components of the test and the total score are a reliable assessment of maturation and of the length of gestation. For all of these systems, no formal training is required as the examination can be easily performed even by inexperienced people by following the instructions included in the recording form. Posture, tone, reflexes, movements, neurobehavioural items are part of the assessment. Limitations: there are several factors that might influence the interpretation of whether a specific finding is normal or abnormal, as illness, convulsions, or medications, but others, such as knowledge of the correct gestational age of the child and the postnatal age, have to be taken into account.

Estimation of the severity of the Hypoxic-ischemic encephalopathy (HIE)

Still, the original Sarnat&Sarnat classification is the scoring system with high specificity- 100% for severe HIE, in detecting neonates who may not have convulsions by 6 months.[15] The positive predictive value to predict convulsions were found to be 63.6% for moderate HIE and 100% for severe HIE. Modifications are made by Portman and Finner [16] [17] The newest modification is that of Thompson,[18] with very high specificity and sensitivity.

Prediction of the overall neonatal outcome

Predicting an individual's prognosis, either for counselling or for stratifying infants into a study, requires the most up to date information on the infant's condition regardless of the influence of the care received. Limiting the data used to those collected within the first few hours of life, when additional information is available on the infant's later progress, is likely to reduce the precision and accuracy of any such prediction.[19] On an individual basis, clinicians may be able to prognosticate as accurately as any scoring system as they can take account of the full and changing clinical picture of a child. Stevens and colleagues showed that clinicians are good at identifying high risk infants but tend to overestimate the risk of death (in other words they provide good discrimination but poor calibration). This warrants further investigation as clinical prognostications are often used in end of life decisions. It is possible that combining clinicians' assessments with a scoring system could improve the accuracy of risk assessment.[20]

Clinical Risk Index for Babies CRIB and Score for Neonatal Acute Physiology (SNAP)

Different tools for assessing and predicting mortality risk among neonates have been developed to overcome the problems imposed by the difference in birth weight, varied causes of neonate mortality, varied pattern of care given at the neonatal units, and other risk factors predispose to neonatal mortality. Clinical Risk Index for Babies scoring system (CRIB score) is developed tool to predict initial risk of mortality amongst low birth weight babies, the utility of which is scarce in many developing countries. Of these tools are Clinical Risk Index for Babies (CRIB), CRIB II, Score for Neonatal Acute Physiology (SNAP), SNAP Perinatal Extension (SNAP-PE), SNAP II, and SNAPPE-II. These scoring systems help in predicting mortality and morbidity and may improve the validity of assessing the outcome among different hospitals and units. The SNAP score developed for babies of all birth weights and validated as a predictor of mortality, morbidity, is a physiology-based score that uses 34 routinely available vital signs and laboratory test results.[21][22]. CRIB and SNAP score are limited to 12 and 24 hours respectively, require sophisticated monitoring and are therefore poor predictors of individual outcome applied in diferent settings.[23]

Morbidity Assessment Index for Newborns (MAIN) score

Few tools have been optimised for use over the entire spectrum of neonatal morbidity and standardised for use in perinatal population and community health studies. Recently was developed morbidity assessment index for newborns (MAIN score). This score was designed as a discriminative index of morbidity for the entire population of babies delivered >28 weeks gestation without a major congenital anomaly.[24] This population includes about 97% of all newborns. The MAIN score is based on items of routine clinical and laboratory examination of newborns. It was designed to be simple and easily completed by retrospective chart review. Its purpose is to reflect morbidity in the first week of life. The specific objective of the design of the MAIN score was to provide a tool to assist population health researchers in comparing healthcare delivery systems available for pregnant women. The MAIN score could also serve as a baseline assessment for subsequent studies of developmental outcomes in infants.

Brazelton Neonatal Behavioral Assessment Scale (NBAS)

The NBAS attempts to capture the behaviors of the neonate fighting with the negative stimuli, and controls interfering motor and autonomic responses in order to attend to important social and nonsocial stimuli. So fa,r few long-term validation studies have been completed, although the scale is in use in many different areas, such as obstetrical medication, predicting to neurological deficits, cross-cultural differences, and with low birth weight infants.[25] This tool has been underused in the UK, but is being used in clinical practice and research in many other countries. It can add value to the assessments already being carried out by health professionals and can contribute to partnership working with parents as together they observe how the infant interacts with and organises his/her world. The NBAS enables health professionals to demonstrate to parents an infant's strengths and abilities, together with any needs for extra care giving. This assessment has been shown to improve developmental outcomes by enhancing the infant-caregiver relationship, and provides health visitors with the opportunity to consolidate their relationship of trust with families.[26]

The NBAS is a multidimensional, multi-item scale and the basic score sheet includes 28 behavioral items, 18 reflex items, and 6 supplementary items. The supplementary items were constructed to measure the quality of the baby's responsiveness, the help the examiner has to invest to get the infant's optimal performance, and also the response of the examiner to the infants.

As a conclusion

Although there are many scoring systems and scales for detecting risks in neonates, none of them is of unique value, and still the clinicians' opinion is the leading force in assessment, treatment and prediction of the neonatal outcome. All of them should be used consciously and in accordance with other determinants of health.

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