Routine Evaluation of Blood Pressure, Hematocrit, and Glucose in Newborns

Committee on Fetus and Newborn

It is the practice in many newborn nurseries to measure routinely, upon admission, each neonate's blood pressure by cuff oscillometry, blood glucose level by Dextrostix or Chemstrips, and hematocrit value via heel stick. Blood pressure is measured to screen for hypertension or hypotension; blood glucose, for hypoglycemia; and hematocrit, for anemia or polycythemia.

The routine testing of all newborns for a particular disorder before clinical manifestations are evident (universal screening) should result in a positive benefit-cost ratio. The following criteria should be considered in evaluating the benefit-cost ratio for any universal screening.

Incidence. There should be a high enough incidence of the disorder to justify screening for it unless the outcome of the disorder, if left undetected and untreated, would result in such significant morbidity that even with a relatively low incidence the benefit-cost ratio of screening would be positive (eg, phenylketonuria screening).

Methodology. The screening methodology should have a very high sensitivity so that there will be no, or a very low percentage of, subjects reported as being negative who are actually positive. The methodology should also have a high specificity so that there will be relatively few infants who are reported as being positive who are actually negative. The specificity need not be as high as the sensitivity since a true-positive test can be confirmed using a more specific methodology. In addition, the methodology should be relatively simple, cost-effective, accurate, and reproducible.

Natural History. The disorder for which infants are being screened should be a clearly defined entity with a well-described natural history.

Treatment. The disorder should be one in which detection and early treatment will improve the outcome.

MEASUREMENT OF BLOOD PRESSURE TO SCREEN FOR HYPERTENSION OR HYPOTENSION

Incidence. The incidence of hypertension or hypotension is largely dependent on how each condition is defined. The Task Force on Blood Pressure

The recommendations in this policy statement do not indicate an exclusive course of treatment or procedure to be followed. Variations, taking into account individual circumstances, may be appropriate.

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Control in Children recommended that systolic and diastolic blood pressures at or above the 95th percentile be labeled as hypertensive.¹ These high blood pressure measurements must be obtained on at least three separate measurements. In one study in which the criteria for hypertension were not clearly delineated, the incidence of hypertension was reported as 2 per 1000 based on blood pressure measurements of 10 000 babies.²

One reason for routinely measuring blood pressure upon admission to the nursery is to detect the presence of coarctation of the aorta in otherwise asymptomatic infants. The incidence of coarctation of the aorta is about 0.2 per 1000 livebirths.³ However, we do not know how many asymptomatic infants with coarctation of the aorta have hypertension at birth in the absence of a detected heart murmur or decreased femoral pulses. This is the population that would benefit from universal blood pressure screening because most blood pressure measurements would otherwise be obtained in symptomatic infants or in infants with a heart murmur or decreased femoral pulses.

If hypotension is defined as a blood pressure below the fifth percentile, then 5% of all infants should be hypotensive. However, the incidence of asymptomatic hypotension is unknown.

Methodology. Measuring blood pressure by the oscillometric cuff technique is relatively simple and need not consume much time. However, there are many potential technical difficulties in the measurement of infant blood pressure such as the necessity for use of proper cuff size and cuff placement. In addition, the level of activity of the infant can affect blood pressure measurement so that accurate, reliable measurement may be difficult. Few data exist to judge sensitivity and specificity of the technique, except for one study of premature infants⁴ that showed that 9% of the infants developed hypertension during the first year of life, although blood pressures measured in the newborn nursery were recorded as normal. This study suggests that blood pressure measurement in the nursery has a low sensitivity for predicting hypertension later in life.

Natural History. As previously mentioned, hypertension in the newborn period is not clearly defined, and little is known about the natural history of neonatal high blood pressure. Similarly, there is not much information available to ascertain the natural history of asymptomatic hypotension in the newborn infant. *Treatment*. There is no evidence that treatment of asymptomatic hypertension or hypotension per se in the newborn period is necessary. On the other hand, recognition of the presence of hypertension or hypotension in an asymptomatic infant may prompt further studies that could delineate a treatable cause.

Thus, newborn screening for hypotension or hypertension fails to meet any of the criteria for universal screening, with the possible exception of the treatment criterion.

MEASUREMENT OF BLOOD GLUCOSE BY DEXTROSTIX OR CHEMSTRIPS TO SCREEN FOR HYPOGLYCEMIA

Incidence. The incidence of hypoglycemia varies depending on the criteria used for the definition.⁵

Even if a glucose level of 30 mg/dL is used as a cutoff value for hypoglycemia in full-term infants, the reported incidence of hypoglycemia varies from 0.4% to 11.4%.^{6,7} Risk factors for the development of hypoglycemia have been described.⁸ However, in one study 72% of 232 infants were found to have one or more of these risk factors.⁹ None of the infants without the risk factors had hypoglycemia (defined as a blood glucose value, measured by Dextrostix, of less than 40 mg/dL); of those with at least one risk factor, 28.6% had hypoglycemia.

Methodology. Dextrostix and Chemstrips have been shown to have a great degree of variance from true blood glucose levels.⁵ Thus, even if a certain level of blood glucose was known to represent hypoglycemia, these methodologies would not be valid predictors.

Dextrostix and Chemstrips are simple to use and inexpensive but, as mentioned previously, are not very reliable. Glucose oxidase analysis is more accurate, but it is impractical as a universal screening technique.

Natural History. Very few data are available about the natural history of hypoglycemia in the newborn because the disorder is usually treated as soon as it is detected.

Treatment. There is a simple treatment that is effective for most cases of hypoglycemia, ie, the administration of glucose. However, no study has shown that treatment of a transient low blood glucose level offers a better short-term or long-term outcome than the outcome resulting with no treatment.

Universal neonatal admission screening for hypoglycemia with Chemstrips or Dextrostix fails to meet the screening criteria for methodology and for natural history. Furthermore, there is no evidence that asymptomatic hypoglycemic infants will benefit from treatment. Selective testing for hypoglycemia in high-risk infants may be more appropriate. However, in those nurseries where more than half the infants meet the criteria for high risk,⁹ there is little advantage to limiting screening to the high-risk infants, and screening of all infants may be appropriate.

MEASUREMENT OF HEMATOCRIT TO SCREEN FOR ANEMIA OR POLYCYTHEMIA

Incidence. The incidence of polycythemia and anemia depends on the definitions. If these disorders are

defined as being present when the hematocrit value is above the 95th percentile or below the 5th percentile, the incidence is 5% of all infants for each disorder. If the disorder is defined as that level of hematocrit that is clinically dangerous, then it must first be determined which level(s) of hematocrit are critical. In addition, the time at which the hematocrit is measured will have a bearing on the result.⁹

Most neonatologists define polycythemia in term infants as a venous hematocrit level greater than 65%. In one study 20% of infants at 2 hours of age had hematocrit values greater than 65%; this incidence spontaneously dropped to 12% at 6 hours and to 2% at 12 to 18 hours.¹⁰

Determination of the incidence of anemia is even more difficult. Most clinicians would describe anemia as a venous hematocrit value greater than 2 SD below the mean. In that case, the incidence would be 3% and would be described as a value for hematocrit below 46%.¹¹

Methodology. Although the methodology for measuring hematocrit is simple and inexpensive, it is often not reproducible or reliable if obtained by heel stick. If the blood sample is taken from a vein, then reproducibility and reliability improve, though the procedure is not as simple.

However, adverse clinical effects of high or low hematocrit values are not predictable. Many patients with venous hematocrit values greater than 65% will not develop clinical signs of hyperviscosity. Thus the specificity of the hematocrit measurement for predicting clinical effects of hyperviscosity is low. The sensitivity of the hematocrit measurement is somewhat better, but there have been reports of infants with venous hematocrit values less than 65% with clinical signs consistent with hyperviscosity.

Natural History. Polycythemia with its resultant hyperviscosity has been studied extensively in animals and its pathophysiologic effects have been well described. In humans, polycythemic infants have a greater incidence of neurologic and developmental deficits than do normocythemic infants, but it has not been clearly determined how much of the deficit is due to the polycythemia and how much to the cause of the polycythemia. For example, infants at risk for polycythemia include infants of diabetic mothers and infants with placental insufficiency; both of these factors may result in infant morbidity independent of the polycythemia.

Treatment. The accepted treatment of polycythemia is partial exchange transfusion. However, there is no evidence that exchange transfusion affects the long-term outcome.

Recognition of infants with asymptomatic anemia should prompt further studies for the causes of the anemia, which in turn may result in appropriate treatment of the anemia or of the cause of the anemia.

Universal screening for polycythemia fails to meet the methodology and treatment criteria and also, possibly, the natural history criterion. Screening for anemia has similar drawbacks, with the possible exception that it may meet the treatment criterion.

SUMMARY AND RECOMMENDATIONS

Based on the criteria for validity of neonatal screening, the following recommendations can be made.

- 1. Universal neonatal screening of blood pressure for hypertension or hypotension is not warranted. Clearly, blood pressure measurements in infants suspected of having renal disease or coarctation of the aorta are advisable. Similarly, infants with clinical signs of hypotension should have their blood pressure measured.
- 2. Universal neonatal screening of blood glucose for hypoglycemia is not warranted in most nurseries. Selective screening for high-risk babies (as defined by Cornblath and Schwartz⁸) may offer an advantage over universal screening; however, in those nurseries where a large proportion of infants fall into one of the high-risk categories, it may be easier to screen all infants. The question of the appropriate age for selective screening still needs to be answered.
- 3. Universal neonatal screening of hematocrit for polycythemia or anemia is not warranted. However, selective testing for polycythemia in highrisk infants (eg, infants of diabetic mothers and infants with placental insufficiency) or for anemia in high-risk infants (eg, infants born to mothers with abruption of the placenta) may be warranted.
- 4. Each nursery should adopt its own guidelines for selective testing of infants at risk for abnormal levels of glucose and hematocrit and abnormal blood pressure.

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