disease prevention news

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Newborn Screening in Texas

The goal of the Texas Department of Health (TDH) Newborn Screening Program (NSP) is to identify infants with phenylketonuria, galactosemia, hypothyroidism, congenital adrenal hyperplasia (CAH), and sickling hemoglobinopathies. The cost of these disorders can be enormous if left untreated, both in human suffering and in economic terms. Early response to these disorders, however, can enable affected children to live longer and healthier lives. This report provides an account of how NSP managed a potentially life-threatening situation that involved twins with CAH. It also briefly describes the 5 conditions and the laboratory methods used to identify them.

It is the policy of NSP case management staff to report abnormal screening results to those who submit the specimens and provide submitters with instructions on patient follow-up. If the actual submitter cannot be contacted right away, any physician who is familiar with the condition and can provide the necessary follow up can receive the report. Due to the need for a rapid response when infants are severely affected with any of the five disorders, the TDH NSP case management team contacts the parents of the newborn directly if an appropriate health professional cannot be located immediately.

A Life-Threatening Situation Involving CAH

Recently, the TDH Laboratory identified CAH, a potentially life-threatening disorder, in specimens collected from newborn twins. Case management personnel were initially unable to locate a physician who could accept the report. The family telephone number on the newborn screening submission form, submitted by the city/county hospital where the twins were born, was not a working number. They had not been seen in any of the local clinics, so no health professionals in the area had contact information for the parents.

Using a cross-reference directory, TDH staff found an address for the family at an Austin apartment complex, and case management personnel immediately sent a certified letter to the mother asking her to take the infants to a physician for further testing. They also spoke with the apartment manager who agreed to pass a message to relatives of the mother. The apartment manager called back to tell case management personnel that the family had moved to San Antonio. Case management personnel alerted the city/county hospital emergency room triage nurses in Austin and San Antonio that these twins might be brought in with severe symptoms and explained the treatment they would need.

Three days later, a physician at an Austin clinic saw the infants and obtained blood for testing, but the clinic did not get a phone number or address for the family. The clinic reported abnormal electrolyte results for both babies to a pediatric endocrinologist who contacted city police to help find the family. Twelve hours later both babies were admitted to a hospital with severe dehydration, but not in true adrenal crisis. They were hydrated and given medication for salt wasting CAH. With education and medication, these newborns have every chance to live normal and healthy lives.

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Legislation and Program Scope

State law (Texas Administrative Code, Title 25, Health Services) requires that all newborns delivered in Texas be screened for the following 5 disorders twice during the first 2 weeks of life: phenylketonuria (PKU), galactosemia, hypothyroidism, CAH, and sickling hemoglobinopathies. The National Center for Health Statistics recorded 349,157 Texas births for 1999, and the TDH Newborn Screening (NBS) Laboratory performed about 3.5 million analyses on 700,000 specimens that year.

A special filter paper card is used to collect blood from the heel of each baby. After the specimens are air dried, they are sent to the TDH laboratory in Austin. Optimally, the first specimen should be collected after the newborn is 36 hours of age and 24 hours after the first protein feeding. If the infant is to be discharged from the hospital before this time, the specimen should be collected immediately prior to discharge. The second specimen should be collected 1 to 2 weeks after birth. Premature, sick, or transfused newborns require special handling for these tests.

Beginning August 2001, the NBS Laboratory implemented new technology for 4 of the 5 screening tests. All of the assays for these diseases except those for hemoglobinopathies were updated. The NBS Hemoglobinopathy Section made a number of procedural improvements related to this new technology.

Disease Descriptions and Incidence*

Phenylketonuria is a condition that affects a person's ability to convert the amino acid phenylalanine into tyrosine. Excess phenylalanine prevents the brain from developing normally. A low phenylalanine diet is the only treatment for phenylketonuria. If the child is monitored closely, normal development can occur.

Quantitation of phenylalanine is based on enhancement of the fluorescence of a phenylalanine-ninhydrin reaction product by the dipeptide, L-leucyl-L-alanine. This fluorometric method measures phenylalanine quantitatively in the presence of other amino acids. In 1999 the TDH identified 16 clinically significant cases.

Galactosemia is caused by the body's inability to convert galactose into a usable source of energy. Galactose builds up in the body, causing liver and kidney problems as well as stunted physical and mental growth and cataracts. These problems can be avoided if the newborn is given a galactose- and lactose-restricted diet within the first few days of life.

Galactose is quantitated by a fluorometric assay that simultaneously measures galactose and galactose-1-phosphate. In 1999 TDH confirmed 32 clinically significant cases of galactosemia.

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*All incidence statistics are from The Council of Regional Networks for Genetic Services 1999 Report (1999 CORN Report).

Congenital hypothyroidism occurs when the thyroid gland does not produce enough thyroid hormone; abnormally low thyroxine (T_4) levels affect normal body growth and brain development. A daily tablet of synthetic thyroid hormone at the proper dose can ensure normal development.

Thyroxine (T_4) quantitation is obtained through a solid phase time-resolved fluoroimmunoassay based on the competitive reaction between europium-labeled T_4 and sample T_4 for a limited amount of binding sites on T_4 specific monoclonal antibodies. Whenever laboratory results indicate an abnormally low T_4 level, a thyroid stimulating hormone (TSH) assay is performed. This solid phase, two-site fluoroimmunometric assay is based on the direct sandwich technique in which two monoclonal antibodies are directed against two separate antigenic determinants on the TSH molecule. In 1999 TDH identified 169 clinically significant cases of hypothyroidism.

Congenital adrenal hyperplasia is caused when the adrenal glands do not produce enough cortisol, resulting in abnormal production levels of 17ά-OH-progesterone (17ά-OHP). Aldosterone and androgen production can also be affected. Aldosterone helps the body maintain normal levels of sodium and potassium. Androgen is important for normal growth. Severe cases can progress to coma 10 to 14 days after birth and death within a few weeks. Less severe cases progress more slowly, but early treatment prevents serious physical development problems. Treatment consists of cortisone and aldosterone replacement.

The laboratory test to quantitate 17ά- OHP is a solid phase, time-resolved fluoroimmunoassay based on the competitive reaction between europium-labeled 17ά-OHP and sample 17ά-OHP for a limited amount of binding sites on 17ά-OHP specific polyclonal antibodies. In 1999 TDH confirmed 23 cases of CAH based on abnormal levels of 17ά-OHP: 14 severe and 9 less severe cases.

Sickling hemoglobinopathies cause anemia and painful crises. The most serious of these conditions is sickle cell disease, for which there is no cure at this time. Treatment involves administering antibiotics to fight infections and drugs to help the body produce healthy hemoglobin. Another important component is education to help parents recognize the onset of a sickling crisis and communicate effectively with emergency room staff.

In the laboratory, the normal and variant hemoglobins of each specimen are separated and identified using isoelectric focusing and high pressure liquid chromatography. NSP testing identifies a wide variety of hemoglobinopathies and thalassemias: 171 clinically significant cases in 1999 (85 of which were sickle cell disease). Hemoglobin variants are also reported, even though they are usually not clinically significant. These variants provide genetic information that may help the affected family, and

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the newborn in later years, make informed reproductive choices. TDH reported 2,300 of these variants in 1999.

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The following web sites have additional information on newborn screening:

www.tdh.state.tx.us/lab/Nbsbrch.htm

www.tdh.state.tx.us/newborn/newborn.htm