



## **American Heart Association Issues First Guidelines on Stroke in Infants and Children**

### *Cord Blood Stem Cells Being Researched as Treatment Option*

The American Heart Association (AHA) recently issued its first guidelines for physicians on diagnosing and treating stroke in infants and children. According to the National Hospital Discharge Survey, the rate of stroke in children is 13.5 per 100,000 (0-18yrs),<sup>1</sup> making it the sixth leading cause of death among children.<sup>2</sup> The guidelines indicate that the risk factors and presentation of infant and childhood stroke vary greatly from those of adult stroke.<sup>3</sup>

#### **What is Stroke?**

A stroke occurs when a blood clot blocks an artery or a blood vessel breaks, interrupting blood flow to an area of the brain. This causes brain cells to begin to die and abilities controlled by that area of the brain are lost.<sup>4</sup>

Perinatal strokes are those that occur between the 28th week of gestation and one month following birth. A stroke that occurs before birth may also be called an in-utero stroke, fetal stroke, or prenatal stroke. Pediatric or childhood strokes occur between one month and 18 years of age. Stroke occurs more frequently in the perinatal and prenatal age group than in older children.<sup>5</sup>

#### **What Are the Causes and Risk Factors?**

Stroke in adults typically stems from high blood pressure, high cholesterol, a history of smoking, excessive alcohol consumption and obesity.<sup>6</sup> By contrast, the most common risk factors for pediatric stroke are sickle cell disease and congenital heart defects. Other risk factors for children include dehydration, head trauma, head and neck infections and systemic problems such as inflammatory bowel disease and autoimmune disorders.<sup>3</sup>

The risk factors for perinatal stroke include cardiac disorders, coagulation disorders, infection, trauma, drugs, maternal and placental disorders and perinatal asphyxia. Potential risk factors derived from the mother include a history of infertility, pregnancy-related high blood pressure, a premature rupture of membranes and infection in the amniotic fluid surrounding an unborn baby.<sup>3</sup>

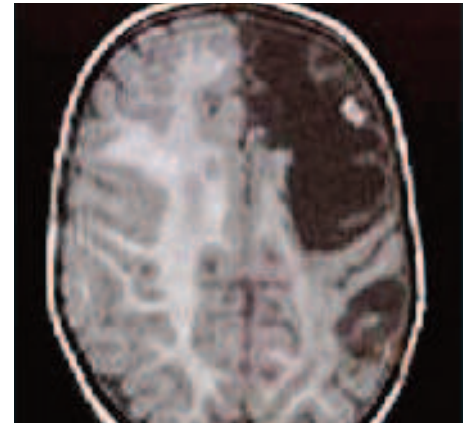
The risk of suffering a stroke among children is greatest during the first year of life; approximately 50 percent of children who suffer a stroke must cope with resulting impairment or disability. According to data published in the AHA's new guidelines, only people over the age of 65 have a higher risk of stroke than do babies younger than a month old.<sup>3</sup>

#### **What Are the Symptoms and Related Disabilities?**

According to the National Stroke Association, on average, it takes 12 to 24 hours for adults to get to the hospital after recognizing symptoms of stroke, but the time increases to 48 to 72 hours for children. This delay is mostly due to the widespread belief that strokes don't happen to children.<sup>6</sup>

In other cases, such as when stroke affects a newborn infant, symptoms may not appear until four to six months of age in the form of decreased movement or weakness of one side of the body. Other earlier symptoms that may be seen in newborns or infants include seizures and extreme sleepiness.<sup>2</sup>

Both children and adults often have problems with speech, communication and paralysis or weakness on one side as a result of a stroke. However, there are some stroke-related disabilities that



The dark portion in the upper right corner of this MRI image is an area of the brain damage by a stroke in an 8-month-old infant. The stroke resulted in a significant deficit of the child's right arm and leg.

Cord blood stem cells have demonstrated the ability to differentiate into nearly any cell type and tissue in the body, a capability called pluripotency - an important characteristic previously thought to be limited to only embryonic stem cells (ESCs). Unlike ESCs, cord blood stem cells are easily and painlessly acquired from a child's umbilical cord immediately following birth. Cord blood is rapidly becoming the preferred stem cell source for medical use and research because cord blood stem cells are able to 1) differentiate in a safe and controlled manner; 2) they have been used in clinical practice for more than 20 years; and 3) they are immunologically younger and appear to be more versatile when compared to bone marrow stem cells.

are unique to children including cerebral palsy, mental retardation or epilepsy.<sup>6</sup>

### **The Need for More Rapid Diagnosis**

As with adults, early diagnosis and treatment of pediatric stroke is critical to recovery. Because pediatric stroke is largely unrecognized by the medical community, the AHA's inaugural guidelines for pediatricians and family physicians will aid in more rapid diagnosis and treatment. According to the guidelines, there needs to be a mindset change among physicians to recognize that symptoms once automatically diagnosed as cerebral palsy or intracranial hemorrhaging may in fact be signs of a stroke.

### **Cord Blood Stem Cells - A Potential New Treatment Option**

The stem cells contained in a child's umbilical cord blood are showing promise as a potential new treatment for neurological disorders, including hemorrhagic stroke, which is more common among infants and children than it is among adults. Although further study is

needed, cord blood stem cells, which are administered intravenously, may provide advantages over more invasive treatment options such as surgery and catheterization. In addition, cord blood stem cells that are saved for a child's own use are immediately accessible, facilitating the rapid treatment that is necessary for stroke victims.

Research has demonstrated convincing evidence in animal models that cord blood stem cells injected intravenously have the ability to migrate to the area of brain injury, alleviating mobility related symptoms.<sup>7,8</sup> As well, administration of human cord blood stem cells into animals with stroke was shown to significantly improve behavior by stimulating the creation of new blood vessels and neurons in the brain.<sup>9</sup>

This research also lends support for the pioneering clinical work at Duke University, focused on evaluating the impact of autologous cord blood infusions in children diagnosed with cerebral palsy and other forms of brain injury. This study is examining if an infusion of the child's own cord blood

stem cells facilitates repair of damaged brain tissue. To date, more than 40 children have participated in the experimental treatment - many whose parents are reporting solid progress.

### **Cord Blood Stem Cell Science Moving Rapidly**

To date, cord blood stem cells are known to treat more than 70 diseases. A movement to explore new areas of study - particularly in the area of regenerative medicine, or the use of stem cells to repair or replace damaged tissue - is underway. Because the science is advancing so rapidly and major advancements likely will occur in the coming year(s), it's important that parents are educated on their cord blood preservation options. For use in regenerative therapies, access to autologous (one's own) stem cells offers better treatment options for patients. Because younger patient populations are more likely to have access to their own cord blood, these kinds of therapeutic advancements may hold the greatest hope among children.

---

## **References**

1. Lynch JK, Hirtz DG, DeVeber G, Nelson KB. Report of the National Institute of Neurological Disorders and Stroke workshop on perinatal and childhood stroke. *Pediatrics*. 2002;109(1):116-123.
2. Children's Hospital of Philadelphia. About Pediatric Stroke. <http://www.chop.edu/consumer/jsp/division/generic.jsp?id=84502>. Accessed May 2008.
3. Roach ES, Golomb MR, Adams R, et al. AHA scientific statement on the management of stroke in infants and children. *Stroke*. 2008.
4. National Stroke Association. What is Stroke. <http://www.stroke.org/site/PageServer?pagename=STROKE>. Accessed September 2008.
5. PediatricStroke.org. 2008 Infant and Childhood Stroke Fact Sheet. <http://www.pediatricstroke.org/stroke-facts.htm>. Accessed September 2008.
6. National Stroke Association. Kids and Stroke. <http://www.stroke.org/site/PageServer?pagename=PEDSTROKE>. Accessed September 2008.
7. Meier C, Middelani J, Wasielewski B, Neuhoﬀ S, Roth-Haerer A, Gantert M, Dinse HR, Dermietzel R, Jensen A. Spastic paresis after perinatal brain damage in rats is reduced by human cord blood mononuclear cells. *Pediatric Research*. 2006;59(2):244-249.
8. Lu D, Sanberg PR, Mahmood A, Li Y, Wang L, Ramos J, Chopp M. Intravenous administration of human umbilical cord blood reduces neurological deficit in the rat after traumatic brain injury. *Cell Transplant*. 2002;11:275-281.
9. Taguchi A, Soma T, Tanaka H, et al. Administration of CD34+ cells after stroke enhances neurogenesis via angiogenesis in a mouse model. *J Clin Invest*. 2004;114(3):330-338.