Prevention of Neural Tube Defects: How Much Folic Acid is Enough?

By Patricia Olney, MS, CGC

"I think I'll go out to the garage and work on the car for a while." This was Daniel's reaction after the birth of his second child with spina bifida. His wife, Rebecca, cried uncontrollably.
Sarah was born in 1989 after a healthy pregnancy, filled with the anticipation of first time parents. The nursery was decorated, the crib was set up, and an overnight bag packed. The only thing Rebecca didn't anticipate was a preterm delivery, c-section, and a baby born with a severe birth defect.

My oldest son was also born in 1989. Rebecca and I shared the same excitement, dreams, and hopes for a healthy baby. We ate a balanced diet, took our prenatal vitamins, exercised regularly, and attended childbirth classes. We talked about whether we wanted an epidural or not, a home birth, or delivery by a midwife. Our husbands advocated for a hospital birth…just in case there was a problem during delivery.

Rebecca remembers the details as if it happened yesterday. On the eve of March 24th, Rebecca's amniotic sac ruptured. Her first thought was "Oh no, I wet the bed!" She didn't realize it was not her urine, but amniotic fluid. She woke Daniel and frantically called her OB. On the way to the hospital, Rebecca was sobbing. She was scared, and worried. What if all the amniotic fluid leaked out? Daniel tried to be reassuring—her OB was a very competent doctor. Sarah was born the next morning by c-section at 34 weeks and quickly whisked away to the NICU by the neonatologist. The preterm delivery was now the least of their worries. Their baby was born with spina bifida.

Rebecca and Daniel were shocked, then angry, and found themselves searching for answers. The book "What to Expect When You're Expecting" didn't cover having a baby with a birth defect. After a long discussion with the neonatologist, they learned Sarah had a type of neural tube defect called myelomeningocele. They heard the words…"she may have neurologic deficits below the level of the defect, and may develop hydrocephalus." Sarah eventually developed hydrocephalus, wasn't able to walk, and didn't have bowel or bladder control.

Spina bifida is a type of neural tube defect (NTD) that affects the spine, or spinal cord. With this condition, the neural tube does not close completely. Myelomeningocele is the most serious type of spina bifida—a sac of fluid with part of the spinal cord comes through an opening in the baby's spine damaging the nerves. Neural tube defects happen in the first month of pregnancy, often before a woman even knows that she is pregnant.

At first, Rebecca and Daniel couldn't imagine having another child since Sarah required so much care, but two years after Sarah's birth, Rebecca and Daniel decided they wanted Sarah to have a sibling. They consulted their OB and decided to have a blood test that screens for neural tube defects called maternal serum AFP. They didn't want to have an amniocentesis, a more sensitive test for NTDs, because of the small chance of miscarriage. Plus, they never thought it could happen twice.

Emma was born in June of 1991 with a less severe type of spina bifida, lower on her spine than Sarah's. At that time, the maternal AFP blood test detected about 80-85% of NTDs. Prenatal ultrasound may not detect one that is small, and covered with skin. In general, when the opening is lower along the spine, fewer nerves are damaged, resulting in less serious disability.

A worldwide effort to prevent recurrence and occurrence of neural tube defects began in the early 1990's. Women who had a pregnancy that resulted in a baby with an NTD have an increased risk of 2-3% to have another affected pregnancy. In August 1991, U.S. Public Health Service provided guidelines for women who already had a pregnancy affected with a NTD. The guidelines called for consumption of 4 milligrams (4000 micrograms) of folic acid daily beginning one month before trying to get pregnant and continuing through the first three months of pregnancy (CDC: MMWR; Aug. 2, 1991).

Folic acid is a water-soluble B vitamin. Foods that are naturally high in folic acid include leafy vegetables, fruits (such as bananas, melons, and lemons) beans, yeast, mushrooms, meat (such as beef), orange juice, and tomato juice. ***Most women would not consume enough folic acid by diet alone.***

In order to reduce the frequency of NTDs and their resulting disability, in September, 1992, the U.S. Public Health Service recommended:

"All women of childbearing age in the United States who are capable of becoming pregnant should consume 0.4 mg (400 micrograms) of folic acid per day for the purpose of reducing their risk of having a pregnancy affected with spina bifida or other NTDs. Because the effects of higher intakes are not well known but include complicating the diagnosis of vitamin B12 deficiency, care should be taken to keep total folate consumption at less than 1 mg per day, except under the supervision of a physician. Women who have had a prior NTD-affected pregnancy are at high risk of having a subsequent affected pregnancy. When these women are planning to become pregnant, they should consult their physicians for advice (CDC MMWR: September 11, 1992)."

In 1998, the Institute of Medicine's Food and Nutrition Board added this to the recommendation:

"To reduce their risk for an NTD-affected pregnancy, women capable of becoming pregnant should take 400 micrograms of synthetic folic acid daily, from fortified foods or supplements or a combination of the two, in addition to consuming food with folate from a varied diet."

Since 1998, folic acid has been added to cold cereals, flour, breads, pasta, bakery items, cookies, and crackers, as required by federal law. CDC reports that fortification is now mandatory practice in 57 countries and voluntary in many others. Three key results are:

• World-wide, at least 22,000 fatal or disabling birth defects such as spina bifida are prevented annually. That's 60 babies a day.
• Countries around the world report 30% to 70% declines in NTDs after fortification begins.
• Countries save millions of dollars in healthcare cost when spina bifida is prevented.

Since one-half of U.S. pregnancies are unplanned and because these birth defects occur very early in pregnancy (3-4 weeks after conception), CDC recommends all women of childbearing age consume folic acid daily. CDC estimates that most of these birth defects could be prevented if this recommendation were followed before and during early pregnancy. Rebecca and Daniel could never change what happened to their babies, but sharing their story may help spread the word about the benefits of folic acid.

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