

# Prenatal Spinal Surgery Improves Brain Function

BY HEIDI SPLETE

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**P**renatal surgery to repair myelomeningocele significantly reduced the need for shunts at 1 year of age and improved children's motor function at age 30 months, compared with children who had surgery after birth, based on data from a randomized trial of 183 pregnant women.

The results, published online, reflect data from 158 children who were evaluated at 12 months of age and 134 children evaluated at 30 months. Data collection is ongoing.

Surgery to repair the opening in the spine is usually performed after birth, but data from animal studies suggest that prenatal surgery could result in fewer complications, said Dr. N. Scott Adzick of the Children's Hospital of Philadelphia and his colleagues.

In the Management of Myelomeningocele Study (MOMS), 183 volunteer women with singleton pregnancies were randomized to prenatal surgery before the 26th week of pregnancy or surgery for their infants after birth (N. Engl. J. Med. 2011 Feb. 9 [doi:10.1056/NEJMoa1014379]).

The children were examined for two primary outcomes. The first outcome, at age 12 months, was patient death or the need for a shunt. The second outcome, at age 30 months, was a composite score of motor function and brain development. The score was based on the Bayley Scales of Infant Development II

(BSID-II) Mental Development Index and the difference between each child's actual ability and their expected motor function based on the severity of their spinal defect.

Death or the need for a shunt was significantly less likely in the prenatal surgery group, compared with the postnatal surgery group (68% vs. 98%). The rates of shunt placement were significantly lower for the prenatal surgery group, compared with the postnatal surgery group (40% vs. 82%).

All the fetuses in the study suffered from hindbrain herniation, in which the base of the brain is pulled into the spinal canal.

But at 12 months, 36% of the children in the prenatal surgery group had no evidence of hindbrain herniation, compared with 4% in the postnatal surgery group. Infants in the prenatal surgery group also had lower rates of moderate or severe hindbrain herniation than did the postnatal surgery group (25% vs. 67%).

In addition, infants in the prenatal surgery group scored an average of 21% higher on measures of mental and motor function, compared with infants in the postnatal surgery group, with primary outcome scores of 149 vs. 123, respectively.

Infants who underwent prenatal surgery were born at a mean 34.1 weeks of pregnancy, compared with a mean 37.3 weeks of pregnancy for the postnatal surgery group.

Significantly more infants in the prenatal surgery group had respiratory dis-

## Major Step in the Right Direction

**A**lthough the results are promising, it is important to be cautious in generalizing the success of prenatal surgery for myelomeningocele to a wider population, Dr. Joe Leigh Simpson and Dr. Michael F. Greene said.

"The study by Adzick et al. is a major step in the right direction, but the still suboptimal rates of poor neonatal outcome and high maternal risk necessitate the use of less invasive approaches if such procedures are to be widely implemented," they said.

Results might be less successful for patients treated in centers that are not as experienced in the procedure, Dr. Simpson and Dr. Greene noted.

In addition, more research is needed to determine which fetuses are

more likely to benefit from the surgery, and whether performing the procedure earlier in gestation would yield even better outcomes, they added.

DR. SIMPSON is at Florida International University in Miami, Fla., and DR. GREENE is at Massachusetts General Hospital in Boston. They made their comments in an accompanying editorial (New Eng. J. Med. 2011 [pub doi: 10.1056/NEJMe1101228]). Dr. Simpson disclosed that he serves on the advisory boards for Rarecells Diagnostics, Novartis, BioDx, and Bayer HealthCare. Dr. Greene is an associate editor for the New England Journal of Medicine.

VIEW ON THE NEWS

tress syndrome, compared with the postnatal surgery group (21% vs. 6%).

In terms of secondary outcomes, children in the prenatal surgery group were more likely to be able to walk without crutches or other orthotic devices, compared with the postnatal surgery group (21% vs. 42%).

The mean age of the pregnant women was 29 years. Each fetus had a myelomeningocele located between the T1 and S1 vertebrae, evidence of hindbrain herniation, and a gestational age of 19.0-25.9 weeks.

Exclusion criteria included a body

mass index of 35 kg/m<sup>2</sup> or higher, increased risk for preterm birth, and fetal anomalies unrelated to the myelomeningocele.

Approximately one-third of the women in the prenatal surgery group showed uterine thinning or an area of dehiscence at the time of delivery. Women undergoing prenatal surgery must understand that they will require a cesarean delivery for the current pregnancy and any future pregnancies, the authors added.

The study was sponsored by the National Institutes of Health. ■

# Girls' Soccer Second to Football for Sports Concussions

BY BRUCE JANCIN

FROM THE ANNUAL MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION

**DENVER** – High school girls have twice the concussion rate of boys playing similar sports, according to an 11-year study conducted in a large public school district.

Not surprisingly, football accounted for the most concussions among participants in the six boys' and six girls' sports examined in the long-term study. But the sport with the second-highest concussion rate was girls' soccer, classified as an incidental contact sport rather than a collision sport, Andrew E. Lincoln, Sc.D., said at the meeting.

He presented a retrospective study of all concussions occurring in athletes participating in 12 sports at 25 high schools in Fairfax County, Va., during 1997-2008. This suburban Washington school district was the ideal location for such a study, because as a matter of district policy a certified athletic trainer was on site for all games and practices, and all injuries – big or small – had to be logged electronically on a daily basis, explained Dr. Lincoln of the sports medicine research center at Union Memorial Hospital, Baltimore.

During the study period, there were 2,479 observed concussions during nearly 11 million athletic exposures. An athletic exposure was defined as a game or practice. Football led the way, accounting for 53% of all concussions. The other boys' sports included in the study were lacrosse, soccer, wrestling, basketball, and baseball. The girls' sports were soccer, which accounted for

7% of all concussions among high school athletes, along with lacrosse, basketball, softball, field hockey, and cheerleading. Another 15 sports are offered in the school district, but they account for relatively few concussions.

Seventy-five percent of all concussions occurred in boys' sports, which accounted for 53% of athletic exposures, Dr. Lincoln observed.

Football had a concussion incidence of 0.6 cases per 1,000 athletic exposures. This was followed by girls' soccer, at 0.35 per 1,000 athletic exposures, and boys' lacrosse, at 0.30 per 1,000. Baseball and cheerleading had the lowest rates at 0.06 per 1,000. That means the incidence of concussion was 10.9-fold greater in football than in baseball, and 6-fold more in girls' soccer than in cheerleading.

Although cheerleading had the lowest concussion incidence among girls' sports, it accounted for 5% of all athletic concussions, putting it in a fourth-place tie with wrestling for that dubious distinction.

In the three sports that are closely similar for boys and girls – basketball, soccer, and baseball/softball – the concussion rate was consistently twice as great for girls. This gender disparity has previously been described at the collegiate level, but this is the first study to demonstrate the same phenomenon at the high school level, according to the researcher.

While both boys and girls play high school lacrosse, these are two very different sports. Boys' lacrosse is a collision sport with helmets and pads. For girls it's an incidental contact sport requiring only eye protection.

The concussion rate in the school district increased by an average of 16.5% annually during the study period for a 4.6-fold jump between 1997 and 2008. The increase was seen in all 12 sports. Football had the smallest annual increase rate, at 8%, while concussions in cheerleaders jumped by 26% per year and in wrestlers by 27% annually.

"The major concerns are football, girls' soccer, and boys' lacrosse. However, the increasing incidence across all sports suggests the focus on concussion detection, treatment, and prevention should not be limited to those sports traditionally associated with concussion risk," according to Dr. Lincoln.

It's unclear whether the explanation for the marked rise in concussion incidence over time is that sports have gotten more aggressive, or coding and diagnosis have improved. Most likely the answer lies in a combination of both, he said.

Why the markedly higher concussion risk in girls compared with boys playing the same sports? Dr. Lincoln said other investigators have put forth three hypotheses. One is that boys' greater muscle mass can absorb more of the impact energy that would otherwise be transferred to the brain. Another possibility is that girls might be culturally more willing to report injuries and seek care. And perhaps hormonal differences are at work as well; studies have shown that girls take longer to recover from concussions.

Dr. Lincoln's study was financially supported by the U.S. Lacrosse Sports Science and Safety Committee. He declared having no relevant financial interests. ■