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Child-Proof

Can cerebral angiography safely map blood vessels of the brain in children?

By Stefanie Carter

Pediatric cerebrovascular disorders, while not common, can be challenging for both physicians and parents of children who have them.

Cerebral angiography is essentially a method of mapping the blood vessels of the brain. It is designed to test for the presentation of such cerebrovascular disorders and is capable of detecting them efficiently.

For years, however, physicians have been reluctant to recommend this procedure in children for fear that it would do more harm than good.

A new study led by Ingrid M. Burger, MD, featured in the October issue of *Stroke*, concluded the procedure is far safer than previously thought.<sup>1</sup> Improvements to the technology and equipment over more than two decades have allowed the technique to evolve into a viable testing option for children in need of safe, accurate diagnosis.

### **About the study**

Cerebral angiograms can be used in patients with cerebral aneurysms, cerebral vascular malformations, stroke, various congenital syndromes and children with brain hemorrhages.

Not since 1981 has there been a study conducted on the safety of cerebral angiography in children. Dr. Burger, along with her colleagues, set out to offer updated information about the procedure to physicians working with patients who could benefit from it.

"We thought it was important to review [the current procedure] so we could get the information to physicians and to parents. That was the goal of the paper," said Philippe Gailloud, MD, an interventional neuro-radiologist at Johns Hopkins and senior author of the study.

The study analyzed 241 cerebral angiograms performed on 205 children at the Johns Hopkins Children's Center between 1999 and 2006. Not one patient suffered intra-procedural complications from the procedure.

The only complication reported was in a child who had gone through the procedure after having a ruptured vascular malformation in the brain. Hours after the angiogram, the child became nauseated and vomited. The pressure generated from the vomiting caused another vascular rupture in the child's brain. While it was not as a direct result of the procedure, the incident is considered a complication.

### **Making improvements**

Cerebral angiograms are nothing new to this area of healthcare.

"We access the vascular system through an artery, usually the femoral artery in the leg or in very small babies it can be the umbilical artery. We go up the aorta to the neck vessels, go selectively into each of the four main neck vessels, inject a dye and take X-ray pictures of the vessels," explained Dr. Gailloud.

In children, smaller systems are used for the outpatient procedure. "Adults are usually done with 5 French (5F) catheter systems, children with 4F catheters. And we like for children to be under general anesthesia. It's much more comfortable for them," he said.

Since the last study, virtually every aspect of cerebral angiography has improved. "The devices we use have improved. The contrast has improved. Everything has improved," he said. "The devices now are smaller, smoother and more supple. They are much less traumatic than they used to be."

Current technology also allows these neuroradiologists to photograph the blood vessels containing the contrast from two separate angles. "That is an advantage because if you can take two views with one injection, you decrease the amount of contrast you use, which is important if you want to spare the kidneys from trouble," Dr. Gailloud said.

### **The child's best interest**

Two of the more common concerns among physicians with regard to ordering a cerebral angiogram for a child were stroke and damage to blood vessels in the legs.

"The main complication people fear, and the reason why people would avoid doing these studies, is the risk of stroke," explained Dr. Gailloud.

"But in children the risk is extremely low—much lower than in adults. [The results of this study make] sense because a child's blood vessels are all clean. They are new. There is no plaque or other bad things [as in an adult's vessels]."

The second concern is trauma to the femoral artery of the leg causing leg issues later in life. "When you go into those leg arteries, they can be pretty small. Especially in the past because of the bigger systems, it was more traumatic to the vessels, causing them to close," explained Dr. Gailloud.

"Most kids were fine with that, but some children would have a difference in leg length. We have been reviewing this [using the newer technology and for] up to three years we've had no instance of leg problems. So there is also reassurance from that perspective."

The study, Dr. Gailloud said, is meant to help clarify the safety of the cerebral angiogram procedure.

"Many physicians—much to their honor—were staying away from these techniques because they thought they were dangerous," Dr. Gailloud said.

Alternatively, many physicians order magnetic resonance angiography (MRA) or computed tomography angiography (CTA). These are non-invasive techniques that look at blood vessels.

"They are good techniques for screening and to look at large blood vessels," said Dr. Gailloud. "But when it comes to small blood vessels, if you need to have a precise anatomic definition of the problem to plan the treatment for a lesion or if you need a dynamic aspect of things like how the blood is flowing—too fast, too slow—all those details that are crucial to understanding the disease and its management still escape, in a large number of cases, the capability of those non-invasive imaging studies."

The hope of the team that contributed to the study is that physicians will see the cerebral angiogram as an option to offer a more in-depth view of their patient's problem—and to decrease undiagnosed conditions.

"It's not unusual for us to find kids who have been undiagnosed after multiple MRAs and CTAs and the angiogram ends up giving us the answer—sometimes too late," Dr. Gailloud explained.

"I saw a child who had a brain hemorrhage followed up with MRA, everything was normal and then he bled again. They brought him in for an angiogram and we found a relatively sizeable vascular malformation that escaped detection by these non-invasive techniques. So there is the risk that non-invasive studies can falsely reassure you, and don't show the real disease," he said.

### **Further horizons**

"[Physicians have been] denying useful information to the patients thinking they were helping the patients avoid any complication. This study is to help clear their minds of that notion and, when appropriate, really ask for this to be done thinking in reasonable terms," Dr. Gailloud said.

While the team at Johns Hopkins plans to continue this study, the number of pediatric patients is about 10 percent to 15 percent of the adult patients seen at the facility.

"The more we recruit patients, the more we will be able to be precise with the numbers. One of the problems of pediatric interventional neuroradiology is that there are a very limited number of patients if you compare it to adult patients," he said.

"There is a need for us to really clarify what we're doing and to do that we need multi-center studies. That's something we need to work toward in the future."

### **Reference**

1. Burger, I., et al. (2006). Safety of cerebral digital subtraction angiography in children. *Stroke*, 37, 2535-2539.

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