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Academic Advance

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English is basic to academic advance

Dear (lovely) Readers :

Here is an article on the arteriovenous fistula for the column, "English Is Basic To Academic Advance" that we would like you to read. We are sure that it will be very informative and serve our purpose just perfectly. It was left understood that for those who feel like using our service, such as writing a letter to SMJ to check if your understanding of the article is all right, can do so by writing Thai or English letter to us.

We are much much more than happy to respond to your letters. Please enjoy the article! And so long.

1. When clogging arteries is good medicine

A pounding, rushing noise behind his right ear was Gerald Eisemann's first sign of trouble.

The noise was only a minor annoyance at first, but it grew so loud that it kept him awake at night. Even more alarming were the headaches and slightly blurred vision that showed up a few months later. Together, the symptoms were warning the 54-year-old dentist that something potentially serious was wrong inside his head.

Eisemann saw his doctor and was referred to a series of specialists at the University of Michigan Medical Center, where an arteriogram, an X-ray of the blood vessels, pinpointed the source of concern. Buried in his brain about an inch beneath his ear was a vascular malformation known as an arteriovenous fistula.

Dentist Gerald Eisemann missed only one day of work following a catheterization to treat a vascular malformation in his brain. With traditional surgery, he'd have spent a couple of days in the intensive care unit, about a week in the hospital and up to a month at home. "Compared to what I would have gone through if this type of procedure wasn't available, this seems like a whole lot easier way to go," he recalls during a break between patients at his practice in Saline.

This abnormal passageway in Eisemann's bloodstream was diverting huge amounts of blood from an artery diectly into a nearby vein that wasn't built to handle the high-pressure flow. The noise in Eisemann's ears was the sound of blood rushing through this dangerous circulatory detour. Left untreated, the malformation presented a low risk of hemorrhage that could cause brain damage.

That was the bad news. The good news was that while such vascular malformations traditionally have been corrected surgically, Eisemann's doctors thought he could avoid an operation to open his skull. A new approach based on the same radiological technology that diagnosed his problem could also probably cure it.

Eisemann's case is just one example of how radiologists now can treat medical conditions - not just diagnose them. By injecting a radiopaque dye, or contrast medium, into the blood vessels so they'll be visible on an X-ray, radiologists can maneuver through the blood vessels to reach any part of the

body with a flexible catheter bearing tools for treatment.

Cardiology was the first discipline to adopt this approach, using catheters equipped with tiny balloons, shaving devices or lasers to open heart arteries. Now radiologists are using similar nonsurgical techniques to close blood vessels for therapeutic effects as well. They're using the approach not only to treat vascular malformations, but also to shrink tumors and remove birthmarks such as port-wine stains. They're even able to stop strokes in progress.

In many cases, catheter-based interventions are replacing traditional operative procedures. In others, they are being used as adjuvant therapy prior to surgery to reduce blood flow at the site of the operation, which makes the surgeon's job safer and easier.

John P. Deveikis, M.D., an assistant professor of radiology, routinely uses catheters to deliver occluding agents to stem unwanted blood flow in the treatment of vascular malformations and tumors. Embolizing materials delivered via catheter include glue, tiny plastic beads, alcohol, metal coils and even silk thread. For example, at high concentrations, alcohol "sort of cooks, or pickles, the inside of the vessel," Deveikis says, effectively destroying that portion of the artery. The introduction of a tiny piece of silk thread into a vessel, on the other hand, causes blood to clot, provoking an inflammatory response that closes the vessel permanently.

The catheter that delivers the therapy is inserted into the femoral artery through a small incision in the groin. The catheter is then threaded through the vascular system to the vessel that feeds the malformation or tumor. Once the catheter is in place, Deveikis checks to make sure that the targeted artery isn't supplying blood to the brain or to a critical nerve. "We inject dye into that one vessel and take a picture to make sure the dye just goes to the intended area and not anywhere else," he explains. He double-checks by delivering a small dose of anesthetic or barbituate through the catheter. Patients remain conscious and alert throughout, so Deveikis can ask them a quick series of questions to test their neurological function. If the patient can't count the doctor's fingers or feel a light stroke on the cheek, the barbitutate - and therefore the artery in question - is reaching the patient's brain. If there is no loss of function, it's presumed safe to block the vessel.

Deveikis planned two such procedures to correct Eisemann's vascular malformation: the first to stem arterial blood flow, the second to block the fistula from the venous side. In his case, both alcohol and tiny pieces of silk suture were used to halt circulation.

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A WEEKEND RECOVERY

Eisemann's symptoms faded away after the first procedure. Just two days afterward he reported, "The noise .is completely corrected. I was having severe pain when I coughed or strained and that also seems to have abated." the only lingering side effect was a headache centered at the site of the occluded arteries behind his ear. The discomfort was relieved with tylenol 3 and a heating pad.

Eisemann was discharged from the hospital within 24 hours and missed only one day of work at his dental practice in Saline. After a weekend recovery at home, he was back in his office on Monday.

If the fistula had instead been corrected surgically, Eisemann would have faced at least six hours in the operating room, up to two days in an intensive care unit and about a week in the hospital, Deveikis says. "He would have had a sore head for a week or two and would have been recovering for three or four weeks."

When Eisemann returned to the hospital for the second procedure about a week later, an arteriogram showed that the fistula was blocked so completely that further treatment was unnecessary.

While such procedures are highly effective, they do not necessarily cost less than surgery because the equipment involved is quite expensive. The payoff is in increased safety and reduced recovery time. "There is certainly less discomfort and people are disabled less. They are back to work sooner," Deveikis says. "There also is a psychological advantage. People don't feel as if they have been invaded as much."

For Eisemann, the treatment was relatively painless. "I had no major discomfort at all--other than lying on the hard slab of the procedure table all aftermoon," he recalls with a chuckle. "I felt some sensations of heat but that was very minor. Compared to what I would have gone through if this type of procedure wasn't available, this seems like a whole lot easier way to go."

The technique is't as easy for the radiologist. It takes a great deal of practice, skill and a special touch to snake a catheter through the body, especially

into delicate circulatory pathways inside the brain. Throughout Eisemann's procedure, Deveikis was guided by images of arteries on a nearby monitor that looked like an aerial map of a river delta plain. Unlike the rivers on a map, however, the position of the vessels kept shifting subtly.

A CHALLENGE AT EVERY TURN

While interventional techniques greatly reduce the risks of subsequent surgery, they aren't risk-free themselves. "It's possible to perforate arteries with the catheter, especially when you get into the brain. Arteries take a lot of twists and turns; at every turn there is the potential to injure a vessel wall," Deveikis says.

Stroke is another potential complication, especially when a major artery is involved. To help predict who's at greatest risk of having a stroke on the operating table, Deveikis conducts a "dress rehearsal" to see how the patient's brain will respond when an artery is closed. Using a balloon catheter, he briefly blocks the artery in question while a PET scanner records the brain's blood flow activity. (PET scanning, or positron emission tomography, produces three-dimensional images that reflect the metabolic and chemical activity of tissues being studied.) If the circulation is dangerously compromised, the procedure is abandoned and other treatment options are considered.

"With PET, we can do a test occlusion beforehand to pick out the people who would otherwise get into big trouble," he says. The U-M is the only institution in the nation using PET scans to preview cerebral blood flow before arteries are permanently blocked. PET's main advantage over other imaging techniques is that the artery only needs to be closed for a minute or two to get a highly detailed, accurate image. Most other imaging techniques, such as Xenon CT (computerized tomography) blood flow studies, require vessels to be shut for up to half an hour before a picture can be obtained. The less time the balloon is inflated inside the artery, the less chance there is of injuring the vessel.

In most cases, however, the benefits seem to outweigh the risks. Most patients with malformations like Eisemann's find that the noise in their ears is silenced immediately after treatment. "We've seen an 80-percent success rate at improving symptoms of dural arteriovenous malformations with each individual procedure. With each additional treatment, we have a higher and higher chance of completely eliminating the symptoms," Deveikis says.

Some symptoms, such as blurred vision, fade away more slowly because the brain has compensated for the altered blood flow and takes time to readjust once the defect is corrected.

STROKE PATIENTS IMPROVE 'RIGHT BEFORE OUR VERY EYES'

While it's not unusual for some symptoms to clear slowly, in another use of this technique Deveikis has seen patients improve "literally right before our very eyes."

He is studying the use of catheter-based interventions to stop strokes in progress and soon plans to begin clinical trials of the technique at the U-M. "In most strokes, there is a certain amount of time where a clot blocks blood flow to the brain and the patient has symptoms but they are not irreversible. The brain is sick but not yet permanently injured. If we can get to the patient in that critical time and break up the obstruction in the vessel, we can prevent irreversibble damage to the brain," he says.

Patients who show symptoms of a developing stroke will be given a clot dissolving drug delivered by catheter to the site of the obstruction. The drug, urokinase, is widely used to treat heart attacks and blood clots in the legs. "What we've seen is that almost in front of our eyes, comatose patients may wake up; they also may begin moving a part of the body they couldn't move before," Deveikis says of the limited number of stroke patients he's treated with the technique.

"The problem is, to be effective we've got to get at the obstruction quickly. After a couple of hours, the brain is irreversibly damaged," he says. The window of opportunity is always less than 24 hours after symptoms begin; in some patients, he says, "I wouldn't attempt it after six hours."

The first use of catheter-based stroke intervention techniques was in the mid'80s in Germany. Today, about a dozen centers in the United States and Canada are performing the experimental procedure.

In a parallel study, Deveikis and others are testing another thrombolytic drug, tissue plasminogen activator, or t-PA, to see how effectively it dissolves clots when given intravenously during an acute stroke. The intravenous approach is less invasive and less specialized than catheterization, so it may be more

widely applicable. On the other hand, intravenous therapy relies on a large dose circulating through the bloodstream, which may increase the chances of hemorrhage--a major complication with thrombolytic drugs. "I have a feeling that injecting a small dose of the drug into the artery at the site of the obstruction is going to work better," he says.

TREATING TUMORS MORE SAFELY, EASILY

Deveikis also specializes in using catheter-based techniques to treat tumors in the brain, head, neck and spine-- areas where there is a great deal of blood flow and many delicate nerve structures.

"These tumors tend to have a lot of blood supplying them. Operating on them can be difficult because of the tremendous bleeding," he says. Surgeons typically spend a great deal of time clearing away blood to make sure they are removing all of the tumor while sparing normal structures.

To help make the sugeon's job easier, Deveikis beforehand will inject tiny plastic beads through a catheter to diminish the tumor's blood supply. The beads then wedge themselves into the vessel, blocking blood flow. Without an adquate blood supply, a tumor will soon start to shrink, thus making it easier to remove a day or two later.

William R. Carroll, M.D., an instructor of otolaryngology and a member of the U-M Comprehensive Cancer Center, routinely makes use of these preoperative treatments before removal of head and neck tumors. He finds that the procedure offers advantages for patients and surgeons alike. "Using embolization techniques drastically reduces blood loss during surgery. It helps us keep patients stabilized from a hemodynamic point of view. It also makes it easier for us to see what's going on for more complete tumor removal," he says.

BORDERING ON REVOLUTIONARY

Surgery Professor William Chandler, M.D., also a Cancer Center member, frequently uses the technique when removing brain tumors or surgicaly correcting aneurysms and other injuries or malformations of cerebral vessels. "There is no question that it's a significant step forward in safety for individuals with these problems. The risk of stroke is less and the need for a blood transfusion with its associated risks is reduced. It allows us to completely treat some problems without open surgery at all. It's really a major difference," he says. In some cases, he feels, such radiological intervention borders on the revolutionary.

"Almost in front of our eyes, comatose patients may wake up; they also may begin moving a part of the body they couldn't move before."

Although there haven't been controlled trials comparing the outcomes of similar patients treated with and without interventional radiology, most surgeons seem to feel that it significantly improves the situation at the time of surgery. "Pretty clearly and convincingly it makes a difference. Surgeons who have tried both approaches seem to be happy with it," Carroll says.

Neurological applications of catheter-based interventions were first tried at some medical centers in the 1970s but remained highly experimental until the mid-to late-'80s. Today, about a two dozen centers nationwide are using these techniques frequently.

TREATING PORT-WINE STAINS FROM THE INSIDE

Interventional neuroradiology procedures also are used to treat vascular malformations in the skin and subcutaneous tissues that cause marks such as port-wine stains. While surgical approaches to correct these malformations can be quite difficult, transvascular methods of treating such lesions from the inside can offer better results in some situations. In such cases, the occluding agent is usually alcohol.

The ability to make a difference--whether it's removing a port-wine stain or shrinking a tumor--is just one of the many reasons why Deveikis chose to specialize in interventional radiology. "There are a lot of technical things involved that I find interesting: the equipment, the images, the variety of therapeutic agents and the very complicated anatomy. Also, it's a very human field, because patients are often awake and interacting with us during the procedure. We see the results immediately. In cases that are successful, I really feel like we've *done* something."

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