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Detachable leak balloon with IBCA/NBCA for treatment of aneurysm.

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FORUM

Editor's note: The following comment was received by the Editor. It concerns an article by Drs Lane and Marks that was previously published in the AJNR.

Detachable Leak Balloon with IBCA/NBCA for Treatment of Aneurysm

In a recent case report (1), the authors describe balloon migration through the dome of an aneurysm, and state that small aneurysms make balloon placement and exchange of contrast material for polymerizing agents difficult. Since I have been treating aneurysms by means of detachable leak balloons with IBCA/NBCA, I have been able to overcome these problems. Many therapeutic interventions have been attempted by means of either detachable balloons or coils, but these techniques are considered unsafe because of their intricacy and/or unreliability. As previously reported, IBCA/NBCA has the potential complication of fixation of the catheter to the vascular lumen. I reevaluated this complication and its application to fixation of balloons in aneurysms. First, a detachable leak balloon catheter is introduced into the aneurysm. Then, IBCA/NBCA is injected so that the balloon is fixed into the aneurysmal dome. Finally, the balloon is inflated appropriately for total occlusion, and detached electrically. This method is a simple and definitive interventional radiologic therapy for aneurysms. I expect it will have widespread clinical application.

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Reference

1. Lane B, Marks MP. Coil Embolization of an Acutely Ruptured Saccular Aneurysm. *AJNR* 1991;12:1067–1069

Editors's note: The above remarks were referred to Drs Lane and Marks for their comments.

Reply

Endovascular occlusion of cerebral aneurysms by intraaneurysmal balloon placement can be used successfully to treat some aneurysms in cerebral circulation (1) however, the technique has significant disadvantages in the acute state and is not applicable to all aneurysms in the circle of Willis. Balloon migration or rupture of the balloon through the aneurysm dome are only a small part of the difficulties that can be encountered with this technique. Incomplete occlusion of the aneurysm, difficulty in balloon placement, and leak of polymerizing material also are important considerations. Dr Kinoshita is to be congratulated for developing a technique to minimize balloon migration. Without knowing considerably more detail of the technique or his experience, we can only comment that it is an interesting idea and wonder about some potential drawbacks of such a method. Injection of liquid adhesive polymerizing agent prior to occlusion of the aneurysm neck could be quite risky, with the potential for migration of the polymerizing agent into feeding or distal vasculature. We would also be concerned about the ability of a liquid adhesive to permanently attach a balloon to the aneurysm dome when this region may be covered by a fresh layer of thrombus. Finally, the method sounds complicated rather than simple, requiring injection of liquid adhesive, proper inflation of balloon, and lastly electrical detachment.

We are encouraged by our results and the results of others using coils for the embolization of aneurysms (2–4). Recently reported results using electrolytic coils point to the need for creation of a system with retrievable coils for safer placement (2). To this end, we have been working on a mechanically detachable system that we believe may provide a safe alternative (5). We believe that the endovascular management of aneurysms is undergoing a significant evolution and, clearly, there are many approaches to this clinical problem. We look forward to seeing more work on this subject.

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2. Guglielmi G, Vinuela F, Dion J, Duckwiler G. Electrothrombosis of saccular aneurysms via endovascular approach. II. Preliminary clinical experience. *J Neurosurg* 1991;75:8–14
3. Lane B, Marks MP. Coil embolization of an acutely ruptured saccular aneurysm. *AJNR* 1991;12:1067–1069
4. Marks MP, Steinberg GK, Lane B. Endovascular coil embolization of intracranial aneurysms. *J Neurosurg* (in press)
5. Marks MP, Steinberg GK, Chee H, Lane B. A retractable coil for the treatment of aneurysms. *Neuroradiology* 1991;S3:S144

Editor's note: In addition to the comments by Drs Lane and Marks, the opinions of three independent observers, with considerable experience in the endovascular treatment of aneurysms, were sought. Their replies follow.

Reply

I have read with great interest the comments of Dr Kinoshita regarding the papers by Lane and Marks (1). I wish to make the following comments:

The first comment which Dr Kinoshita makes concerning the difficulty of exchanging contrast material with polymerizing substance is outdated. We are able to use the double lumen balloon catheter with an exchanging chamber (2).

The criticisms brought forth by Dr Kinoshita might well be leveled against his own technique. Injecting IBCA/NBCA through a detachable calibrated leak balloon in order to "stick" the balloon to the aneurysmal dome, and then inflating the balloon for total occlusion, seems more appropriate for a "juggling show" than an endovascular technique. In addition to the incredible hazard (as well as the difficulty and unreliability) of the technique proposed by Kinoshita, it seems to contain a misunderstanding of the mechanism of the migration of a balloon through the dome of the aneurysm.

If a balloon moves inside an aneurysm, it is because the wall of the sac is not a rigid structure, but rather a soft one that is deformed by the balloon because of a "hammer-like phenomenon" secondary to the pulsating effect of the blood circulation. In addition, "sticking" the balloon to the aneurysmal dome will not protect against dome perforation, which is one way that balloon treated aneurysms may recur. In fact, Dr Kinoshita's technique would be a brilliant one if he was able to "stick" the balloon to the *neck* rather than the dome of the aneurysm. It is not the fact that a balloon sticks to the aneurysmal dome that causes an aneurysm to become occluded. My personal experience in treating more than 170 berry aneurysms (using balloons and coils) and about 400 AVMs (exclusively with glue) by endovascular approach lead me to think that Dr Kinoshita's technique is akin to the discovery of the abacus in the era of the high-speed computer (3).

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1. Lane B, Marks MP. Coil embolization of an acutely ruptured saccular aneurysm. *AJNR* 1991;12:1067–1069
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3. Guglielmi G, Vinuela F, Dion J, Duckwiler G. Electrothrombosis of saccular aneuryms via endovascular approach. II. Preliminary clinical experience. *J Neurosurg* 1991;75:July

Reply

The idea of a detachable leak balloon for liquid acrylic injection (1) has some important dangers that should be clearly stated in any publication that suggests its use for treatment of aneurysms. Saccular aneurysms all have inflow and outflow of blood. While the idea of gluing a detachable balloon to the aneurysm wall sounds good, the imprecision of predicting the polymerization time and an appropriate mixture of acrylic is unforgiving. Any excess unpolymerized glue will congeal and be a distal embolus.

In the early '80s, by personal communication, there were at least two cases of aneurysms, treated by IBCA injected through leak balloon, where the patients sustained immediate fatal strokes. Both cases were well thought-out by individuals who had some experience using leak balloons for liquid acrylic administration to brain AVMs, and in both instances the first case with aneurysm attempted by this technique had embolization of glue from the aneurysm to the middle cerebral territory. In both instances, a major infarction ensued followed by death.

In our own institution, we had the unfortunate experience of a similar outcome from injection of IBCA through a leak balloon into a large fusiform posterior cerebral artery aneurysm. The retrospective understanding of that case should be expounded. In that instance, a small leak balloon was placed into the small lumen of the proximal posterior cerebral artery segment, proximal to a fusiform aneurysm. There was flow arrest within that narrowed segment, and IBCA was injected with fluoroscopic control in the usual manner with the catheter cleansed by dextrose prior to the administration of the glue. On the fluoroscope, the glue was seen to leave the catheter and enter the large lumen of the aneurysm. When a fair amount of glue had been placed into the aneurysm, the injection was stopped and the catheter pulled back. At the same time, unpolymerized glue was sucked back into the basilar artery, causing embolization of various branches, major infarction, and death. The problem, according to our reconstructed understanding, was the necessity to use dextrose, as a nonionic "cleanser" within the catheter lumen, so that polymerization would not be initiated inside the catheter causing it to block. On the other hand, the liquid acrylic entered the aneurysm, filled with dextrose, and did not immediately begin to polymerize. That same risk can be inferred within a saccular aneurysm. If a detachable balloon is occupying much of the aneurysm sac, the dextrose that would precede the liquid acrylic injection could remain around the balloon inside the aneurysm, and could delay polymerization of acrylic until it leaks out of the aneurysm.

Presumably, Dr Kinoshita has found some balance between controlling the polymerization and insuring that it would occur within an aneurysm sac. However, his letter does not describe the details of how he has achieved this balance, and promulgation of techniques of injecting liquid acrylic into cerebral aneurysm without serious considera-

tion of this risk could be disastrous for many patients.

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Reference

1. Debrun GM, Vinuela FV, Fox AJ, Kan S. Two different calibrated leak balloons: experimental work and application in humans. *AJNR* 1982;3:407–414

Reply

Dr Kinoshita makes no statement as to how many patients he has treated, how successful these treatments are, or whether this technique has been used in an animal or human model. If he is so enthusiastic and successful with this technique, I would encourage him to submit his work to a peer-reviewed journal. To date, I have not seen any publications or presentations regarding this proposed treatment modality.

Without reviewing any clinical data, it is difficult to comment on this novel approach. Certainly the concept of filling the aneurysm with liquid adhesives has been tried and has failed miserably, with the embolic material migrating out of the aneurysm sac causing devastating strokes. The idea of putting a balloon at the neck to keep the glue in place has also been tried with variable success rates. Complete occlusion of the neck of an aneurysm by a calibrated leak balloon would seem to be difficult to achieve in clinical practice. If the balloon indeed produces a complete seal of the aneurysm neck, then migration of the embolic material may be prevented. However, when the embolic material is injected it will undoubtedly produce increased pressure in the aneurysm, possibly causing rupture and a devastating sequelum. The idea of electrical detachment seems quite novel. This has been tried before by Dr Taki, however, earlier bipolar electrically detachable delivery catheters prototypes were relatively inflexible. The practicality of this approach will obviously need to be evaluated in animal models and extensive bench testing.

In conclusion, Dr Kinoshita's recommendation of this method of aneurysm treatment seems purely anecdotal, and the fact that no large series has appeared in a peer-reviewed journal makes its use unjustified at this time. However, no currently utilized embolic agent is without drawbacks. We welcome the development of better embolic materials. If Dr Kinoshita has indeed developed a new and innovative therapy for intracranial aneurysms, I encourage him to share this knowledge so we may all benefit from his advances.

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