Intraoperative use of Doppler to detect successful obliteration of carotid-cavernous fistulas

Technical note

M. JANE MATJASKO, M.D., J. POWELL WILLIAMS, M.D., AND MANUEL FONTANILLA, M.D.
Departments of Anesthesiology and Radiology, University of Maryland, Baltimore, Maryland

The authors describe their use of a Doppler flow detector in the treatment of carotid-cavernous fistulas to monitor the ocular bruit, the clinical sign usually used to detect obliteration of the fistula. In seven procedures the Doppler ultrasonic flow detector has yielded satisfactory proof that the flow sounds were no longer audible, and that the surgery was successful.

KEY WORDS • carotid-cavernous fistula • Doppler flow detector • ocular bruit

The treatment of carotid-cavernous fistulas has presented a perplexing problem since 1809, when the phenomenon of pulsating exophthalmos was first described. Various treatment techniques have included digital common carotid compression and/or ligation; ligation of varicose vessels at the inner canthus of the eye; ligation of the cervical internal carotid artery; isolation of the fistula by cervical carotid ligation; ligation of the internal carotid artery intracranially prior to its division into anterior and middle cerebral arteries, with or without intracranial occlusion of the ophthalmic artery (the trapping operation); the trapping operation plus muscle embolization; hypothermia with or without hypotension and common carotid occlusion; direct attack on the carotid artery within the cavernous sinus using hypothermia and cardiac arrest; injection of acrylic into the intracavernous portion of the internal carotid artery at the site of the fistula; gelfoam embolization; and occlusion of the fistula by use of a balloon-tipped catheter.

It is obvious from this array of suggested procedures that no ideal treatment modality has been found. Each fistula is anatomically different, and may have flow characteristics beyond analysis at this time, or significant collaterals increasing with the age of the fistula.

The ocular bruit appreciated by the patient and audible with and occasionally without a stethoscope is the clinical sign commonly monitored to document obliteration of the fistula. However, stethoscopic appraisal of the disappearance of the bruit can be
Doppler for intraoperative proof of fistula obliteration

technically unsatisfactory and objectively difficult in the operating room. We have found that the Doppler ultrasonic flow detector* placed over the involved eye is a more reliable method. Our experience with this technique is presented here.

Technique

All procedures were done during general endotracheal anesthesia with controlled ventilation. The ultrasonic flow detector with an operating frequency of 10 MHz was secured in place over the affected eye (Fig. 1). This frequency gives superior response to small vessels close to the body surface. The Doppler flow sounds were monitored throughout the procedure but more closely at the time that muscle embolization was being performed. Embolization was discontinued and the cervical carotid arteries ligated when the flow sounds were no longer audible.

Results

We have used the Doppler flow detector during seven procedures in four patients. Complete selective angiographic studies were performed prior to surgery and in all but one patient the fistula was obliterated at the first operation. One patient, whose fistula had been present 8 months prior to the first procedure, had temporary relief after three operations. Finally, after the external carotid artery was ligated in the neck (the internal carotid artery had been previously ligated) the patient was free of symptoms at a 12-month follow-up examination.

Discussion

Regardless of the surgical technique used, adequate preoperative angiography and intraoperative documentation of the disappearance of the ocular bruit have proved to be necessary to satisfactory treatment of the fistulas.

Using this technique, we have been able to document easily and accurately that the fistulas were obliterated intraoperatively. To date we have had no recurrences in up to 18 months follow-up period. It is well to note that flow sounds can be heard over normal eyes with pressure over the globe, but in a patient with a carotid-cavernous fistula the sounds have a high-pitched "pinging" quality without pressure over the globe. When the fistula is obliterated the Doppler sounds completely disappear.

References


Address reprint requests to: M. Jane Matjasko, M.D., Departments of Anesthesiology and Radiology, University of Maryland, 22 S. Greene Street, Baltimore, Maryland 21201.