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Duplex Sonography in Embolotherapy of External Carotid Artery Traumatic Aneurysms

Vishan L. Giyanani,¹ Amil J. Gerlock, Jr.,¹ Mansour Mirfakhraee,² Daniel Lew,³ and Richard C. Bryarly, Jr.⁴

Until recently, arteriography has been the method of choice for diagnosing traumatic aneurysms and for follow-up after transcatheter coil embolization [1–3]. Duplex sonography can now play a complementary role in the diagnosis and follow-up of these lesions. Serial duplex sonographic examinations provide a noninvasive method of monitoring the cessation of flow within the aneurysms and their resolution. This report describes how duplex scanning was used in two patients to make the diagnosis of traumatic aneurysms and to observe their progress after embolization.

Case Reports

Case 1

A 15-year-old boy presented with a left preauricular mass 9 weeks after mandibular surgery. A left-sided, mildly tender, firm, nonpulsatile facial swelling persisted postoperatively and at the 2-month follow-up examination. A fine-needle aspiration showed it to contain blood, ruling out an abscess.

Duplex sonography was performed using a Technicare real-time sector scanner with 10-MHz transducer. Duplex sonography showed a predominately sonolucent mass (Fig. 1A). Pulsatile blood flow was present within the mass, which also contained areas of swirling internal echoes. The sonographic diagnosis of a traumatic aneurysm was confirmed by subselective facial arteriography (Fig. 1B). The artery supplying the aneurysm was occluded with a single 3-mm-diameter Gianturco coil (Fig. 1C). Serial follow-up duplex scans were obtained at 3, 6, 13, and 26 days after embolization. On the third day after embolization, duplex sonography showed the aneurysm to be filled with medium- to high-level nonswirling echoes (Fig. 1D) with no flow. A sixth-day postembolization scan showed no significant change in appearance of the aneurysm. Multiple anechoic areas began to develop within the aneurysm 13 days after embolization, and the aneurysm became almost totally sonolucent by the 26th day (Fig. 1E). Needle aspiration removed 4 ml of thick, bloody fluid, decompressing the residual mass.

Case 2

A 33-year-old man developed a 4 × 5-cm tender, pulsatile mass below his right ear 3 days after sustaining a gunshot wound to

the face. An initial examination by duplex sonography using an ATL (Advanced Technology Laboratory) real-time sector scanner with 5-MHz transducer revealed a sonolucent mass arising from the carotid artery consistent with a traumatic aneurysm (Fig. 2A). Arteriography showed the aneurysm to arise from the external carotid artery beyond the take-off of the facial artery.

The aneurysm was then treated by placing a 5-mm-diameter Gianturco coil in the external carotid artery just distal to the take-off of the facial and occipital branches. A duplex scan three days after embolization showed the aneurysm to contain several low-level echoes (Fig. 2B). No residual mass was present either on physical examination or by sonography 1 month after the embolization procedure.

Discussion

Aneurysms of the external carotid artery are rare [1–5]. The causes of the aneurysms are atherosclerosis, trauma, syphilis [6], cystic medial necrosis, Marfan syndrome, and congenital [7]. Traumatic aneurysms occur as a result of a breach in the continuity of the arterial wall [3, 8]. This causes an extensive periarterial hemorrhage because the partially retracted blood-vessel wall creates a persistent opening that is confined by the fascia. The blood is forced into the periarterial area by arterial blood pressure during systole and returns to the main vessel lumen during diastole. Bleeding continues to occur at the site of the leak until the pressure in the periarterial zone equals the mean arterial pressure. Several days or weeks after clot formation and retraction, the hematoma undergoes liquefaction and forms a cavity that is then endothelialized and that communicates freely with the vessel of origin. The aneurysm progressively enlarges as the clot liquifies further. An inflammatory and fibrotic reaction occurs in the adjacent tissue, forming the wall of the aneurysm.

Angiography still remains the procedure of choice for diagnosing an aneurysm and other vascular lesions [1–3, 5, 7]. Angiography not only delineates the size of the aneurysm but also shows any associated abnormality, such as a fistula to adjacent vessels. In the past, treatment of the aneurysm

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¹ Department of Radiology, Louisiana State University Medical Center, P.O. Box 33932, Shreveport, LA 71130. Address reprint requests to V. L. Giyanani.

² Department of Radiology, University of Texas Medical Branch, Galveston, TX 77550.

³ Department of Surgery, Louisiana State University Medical Center, Shreveport, LA 71130.

⁴ Department of Otolaryngology, Louisiana State University Medical Center, Shreveport, LA 71130.

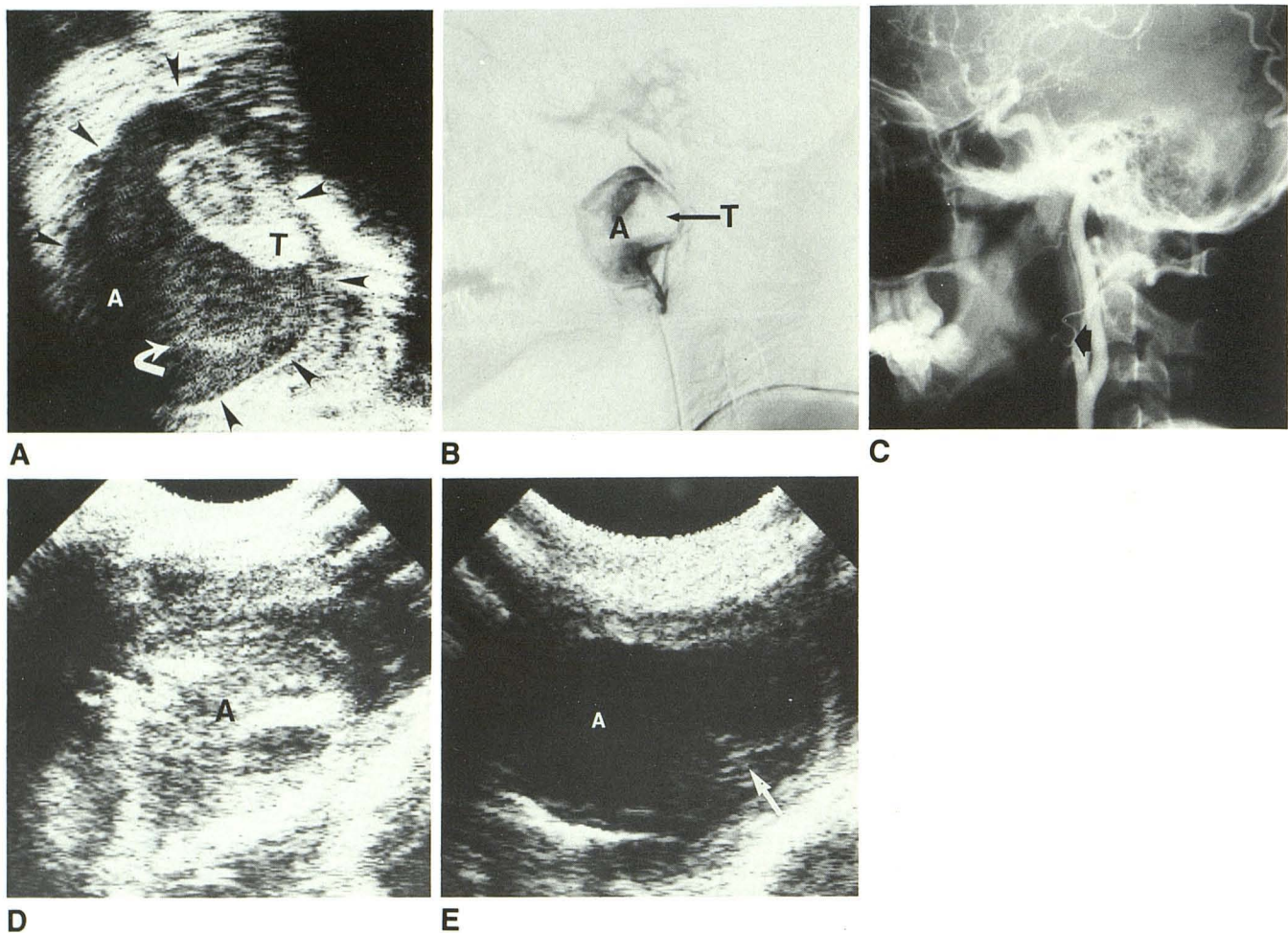


Fig. 1.—Case 1.

- A**, Real-time sonogram shows aneurysm (outlined by *arrowheads*). Anechoic area (A) represents rapid blood flow; hypoechoic area (*curved arrow*) represents sluggish blood flow. Highly echogenic area (T) indicates thrombus formation within aneurysm.
B, Left external carotid arteriogram in lateral projection shows large aneurysm (A) containing a posteriorly located thrombus (T).
C, Postembolization arteriogram in lateral projection shows occluding coil (*arrow*) and absence of aneurysm.
D, Third day after embolization, real-time sonogram shows nonswirling medium-to-high-level echoes that completely fill aneurysm (A).
E, Repeat real-time sonogram 26 days after embolization shows very few echoes (*arrow*) within aneurysm (A).

was surgical resection and ligation [1, 7]. With the advent of interventional radiology, therapeutic embolization with Gian-turco coil may be performed to close the communication between the aneurysm and the main vessel, such as was done in our two cases.

After the embolization, the size and patency of the aneurysm can be evaluated clinically and, if necessary, by repeat angiogram. But a clinical examination and an angiogram cannot demonstrate internal changes occurring within the aneurysm. Duplex sonography can play an important role in that respect. This technique cannot only make the initial diagnosis, it can also evaluate the size, check the patency, and display the changes that occur within the aneurysm after embolization. Prior to embolization, the sonographic appearance of the aneurysm varies from an entirely sonolucent pulsatile

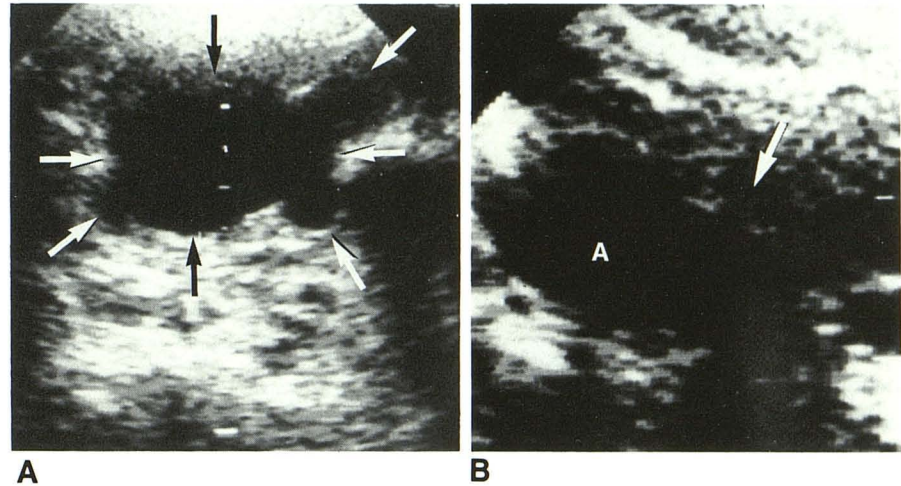
mass (Fig. 2A) to one that is echogenic (Fig. 1A). This change in appearance corresponds to the stage at which the aneurysm is imaged. Rapidly flowing blood has a sonolucent appearance by sonography; therefore, a recently formed aneurysm with rapid flow will also appear sonolucent (Fig. 2A). The presence of radial pulsations and positive flow on Doppler separates an aneurysm from a nonvascular mass. Later, when hemorrhage within the aneurysm undergoes clot formation, retraction, and liquefaction, the blood flow is slowed to such an extent that echoes are produced within the lumen (Fig. 1A). The thrombus will, of course, produce an area of high echogenicity that does not show any flow phenomenon.

After embolization, presence or absence of blood within the aneurysm can be followed by duplex sonography rather

Fig. 2.—Case 2.

A, Real-time sonogram of the neck in area of palpable mass shows lobulated pulsatile sonolucent mass (arrows).

B, Follow-up sonogram shows presence of echoes (arrow) within aneurysm (A).



than by angiography. In addition, duplex sonography is able to follow the natural course of the aneurysm after the embolization. Soon after the treatment by coil embolization, the aneurysm may be filled with low- to high-level echoes, indicating thrombus formation. The thrombus may then undergo liquefaction, which is seen by sonography as an anechoic area. This process may take from seven to 13 days, as seen in case 1 (Fig. 1E). The process of liquefaction continues to occur until the whole aneurysm is occupied by a sonolucent area that then can be decompressed by aspiration. The presence or absence of blood flow on duplex sonography permits differentiation of successfully treated, thrombosed aneurysms from those aneurysms only partially treated and still showing blood flow. In conclusion, duplex sonography can play an important role in diagnosing traumatic aneurysms and in determining their resolution.

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