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Balloons and Coils: Aids in Particulate/Liquid Head-Neck Embolization

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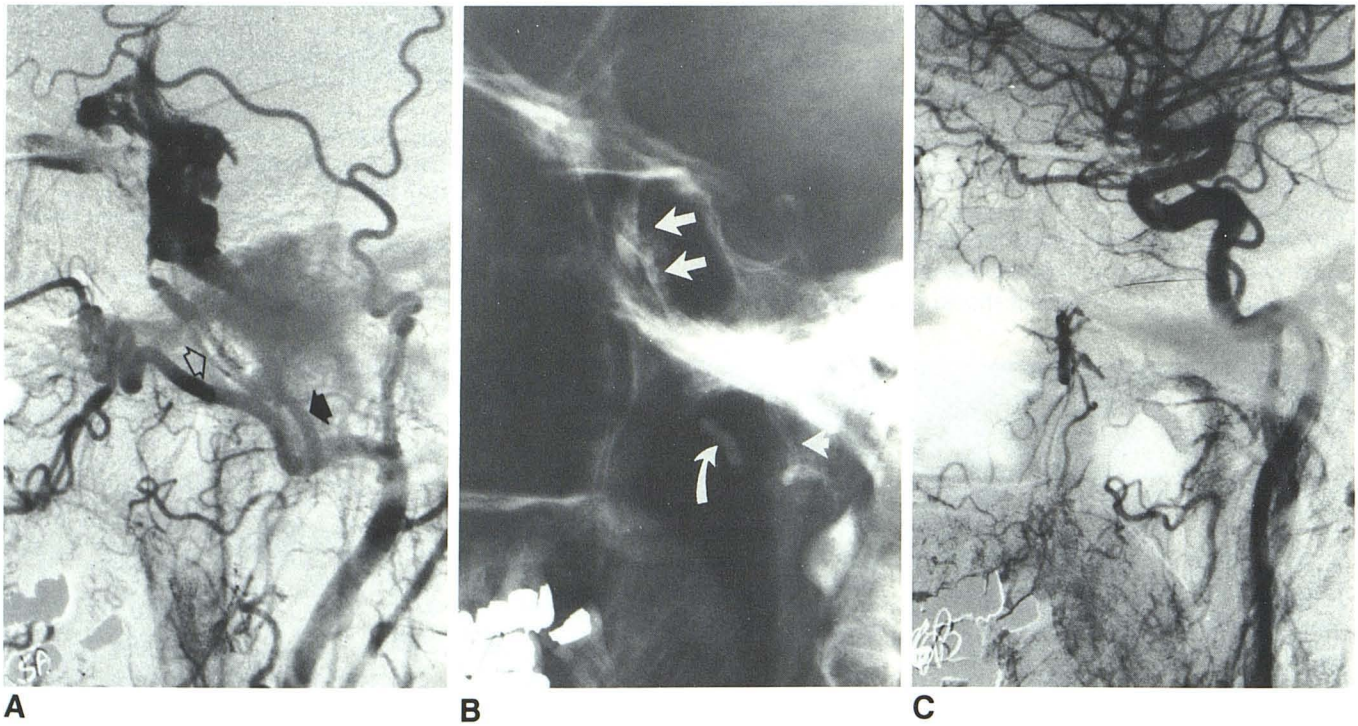
In embolization procedures of the external carotid artery (ECA) system, it is ideal to selectively embolize only the involved feeding branch or branches. This usually requires superselective catheterization, which can be difficult. The catheter diameter may approximate vessel diameter closely enough to reduce flow. Vessel spasm may be generated by catheterization attempts. Spasm may lead to reduced or reversed flow in catheterized vessel.

Under circumstances where the precise feeding branch is not easily catheterized, embolization into the main ECA leads to embolization of uninvolved branches. While usually tolerated without complication, this method requires a greater volume of embolic agent and prolongs the procedure. We have used intravascular ligation with coils and/or detachable balloons to avoid embolization of distal uninvolved vessels.

Technique

Detachable latex balloons were used in three patients and 3 mm coils in two patients to occlude the ECA or one of its



A B C

Fig. 1.—36-year-old man with middle meningeal artery–meningeal vein fistula. **A**, Fistula is fed by middle meningeal artery (*solid arrow*) and accessory meningeal artery (*open arrow*). Catheterization of middle meningeal artery with micro-leak balloon catheter was not successful. **B**, Latex balloon (*curved arrow*) was detached just beyond accessory meningeal artery in internal maxillary artery. IBCA opacified with Pantopaque and tantalum was injected just proximally, filling venous sac (*long arrows*) middle meningeal artery (*short arrow*), and internal maxillary artery. **C**, Postembolization common carotid arteriogram confirms fistula closure.

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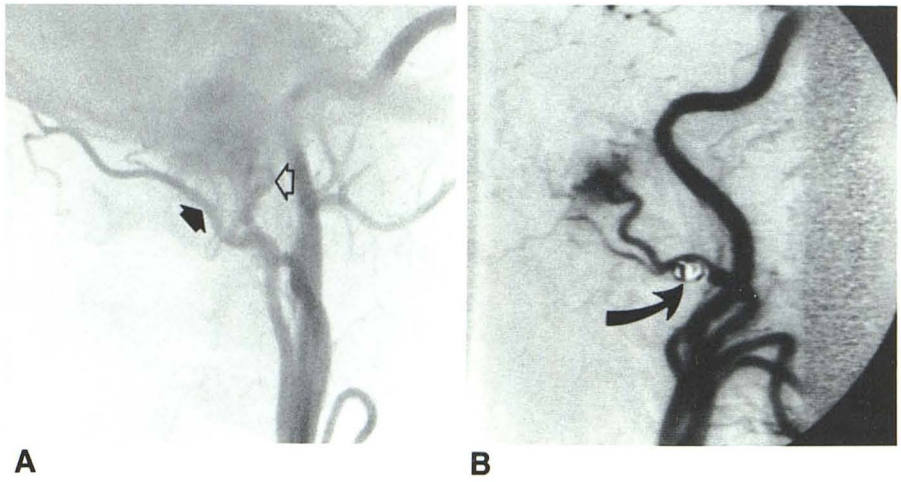

Fig. 2.—56-year-old woman with 3-cm-diam glomus jugulare tumor. **A**, Right common carotid arteriogram. Supply from occipital artery (*closed arrow*) and posterior auricular artery (*open arrow*). **B**, Occipital artery was catheterized and occluded with PVA sponge and gelatin sponge. Selective posterior auricular artery catheterization without flow reduction was not possible, so ECA beyond origin of posterior auricular artery was blocked with 3 mm coil (*arrow*). Further embolization in ECA proximal to coil and posterior auricular artery was then performed.

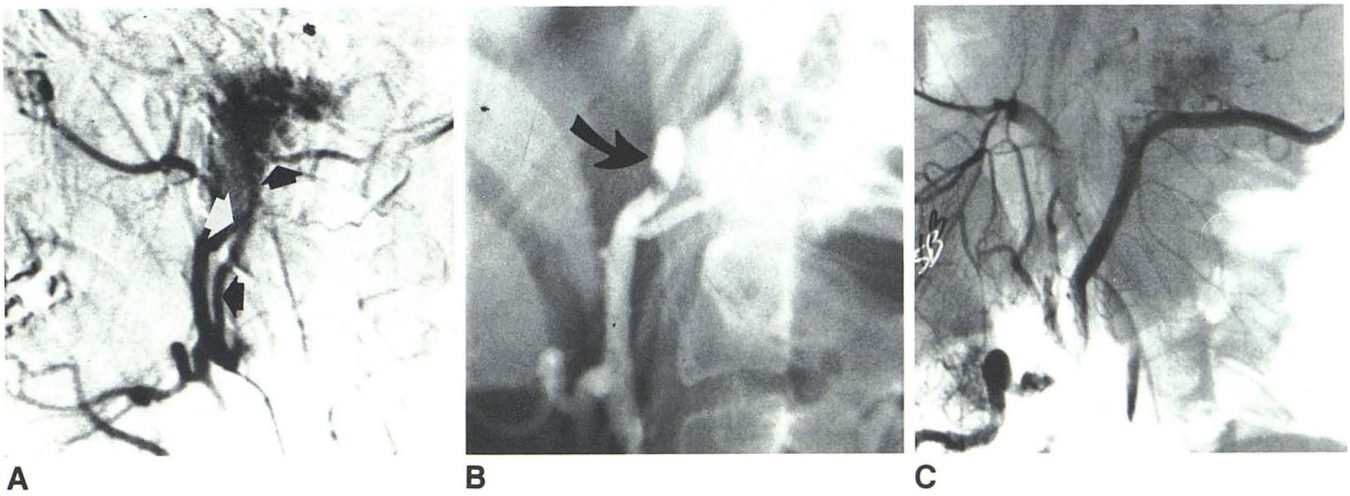

Fig. 3.—24-year-old woman with residual/recurrent chemodectoma. **A**, Digital arteriogram. Tumor stain from occipital artery (*black arrows*); posterior auricular artery (*white arrow*). **B**, Spot film. Contrast-filled detachable balloon (*arrow*) occluding ECA beyond origin of posterior auricular artery. **C**, ECA arteriogram. Marked reduction of tumor stain after PVA and IBCA embolization of posterior auricular artery. Occipital artery was then embolized.

branches as an aid to embolization (figs. 1–4). A latex detachable balloon was used to occlude the vertebral artery in one patient with unusual collaterals after ipsilateral common carotid artery occlusion (fig. 5). Embolization in the five patients was subsequently performed with polyvinyl alcohol (PVA) sponge, gelatin sponge, or isobutyl-2 cyanoacrylate (IBCA). The use of these devices aided and shortened the embolization procedure in these instances. No complications occurred.

Discussion

Ideally, embolic agents are delivered directly into the involved ECA branch or branches only. Unfortunately, the superselective catheterization required is sometimes either not feasible or would require too much time or catheter manipulation (generating spasm) as to be prohibitive.

Intravascular ligation of the ECA (or one of its branches) beyond the involved level aids embolization procedures by preventing embolic material from entering the distal circulation. This prevents ischemic complications because small vessel occlusion by embolic particles might not be well tolerated. Major branch occlusion by a balloon or coil, however, is tolerated due to abundant distal collaterals.

We have used large pieces of gelatin sponge [1] for this same purpose. However, the point of occlusion with gelatin sponge is less predictable, and several pieces may be necessary. The benefit of gelatin sponge is its tendency to recanalize, which will restore flow to the temporarily occluded vessel.

Another useful method of distal vascular occlusion is digital compression of the accessible superficial temporal artery or occipital artery to prevent embolic material from entering their distal circulations.

Detachable balloons are not inexpensive, costing about $75 for a single detachable latex balloon catheter system

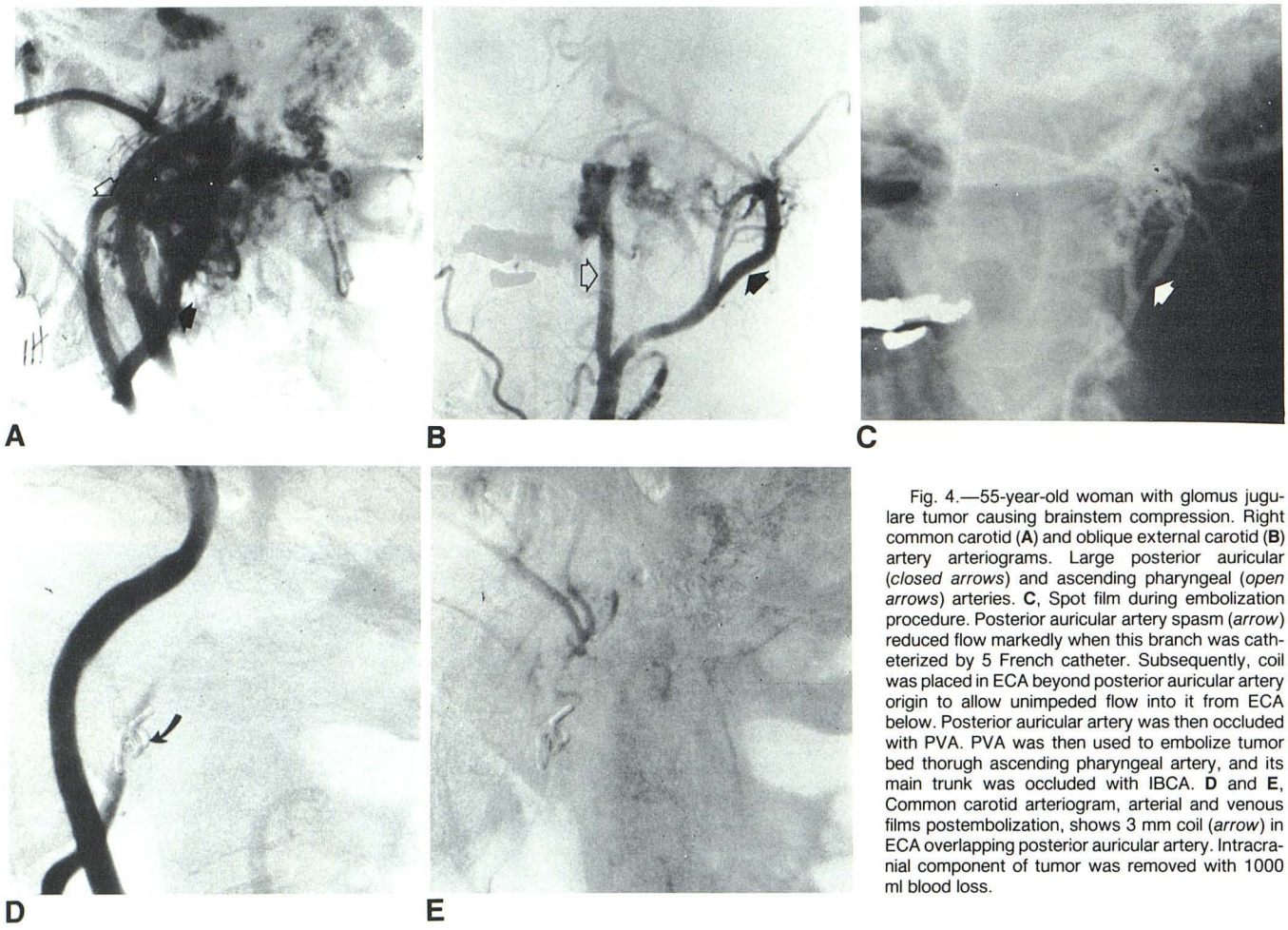

Fig. 4.—55-year-old woman with glomus jugulare tumor causing brainstem compression. Right common carotid (**A**) and oblique external carotid (**B**) artery arteriograms. Large posterior auricular (*closed arrows*) and ascending pharyngeal (*open arrows*) arteries. **C**, Spot film during embolization procedure. Posterior auricular artery spasm (*arrow*) reduced flow markedly when this branch was catheterized by 5 French catheter. Subsequently, coil was placed in ECA beyond posterior auricular artery origin to allow unimpeded flow into it from ECA below. Posterior auricular artery was then occluded with PVA. PVA was then used to embolize tumor bed thorugh ascending pharyngeal artery, and its main trunk was occluded with IBCA. **D** and **E**, Common carotid arteriogram, arterial and venous films postembolization, shows 3 mm coil (*arrow*) in ECA overlapping posterior auricular artery. Intracranial component of tumor was removed with 1000 ml blood loss.

[2]. However, they assure a simple, quick occlusion delivered at precisely the desired location with a minimum of arterial trauma. Recanalization is unlikely.

Coils are less expensive (about $9 for a 3 mm coil) and can be delivered through a smaller catheter, but they present the risk of greater arterial trauma for more distal placements [3]. This creates the possibility of generating spasm, which could lead to abortion of the procedure.

Newer catheter designs make superselective catheterization easier [4, 5]. While resorting to balloons and coils may suggest a less experienced angiographer, it also could reflect a healthy aversion to generating spasm, which might endanger flow-controlled embolization [6]. Our experience indicates that the detachable balloon and coil are useful aids as intravascular ligatures to prevent distal passage of embolic material when superselective catheterization is difficult.

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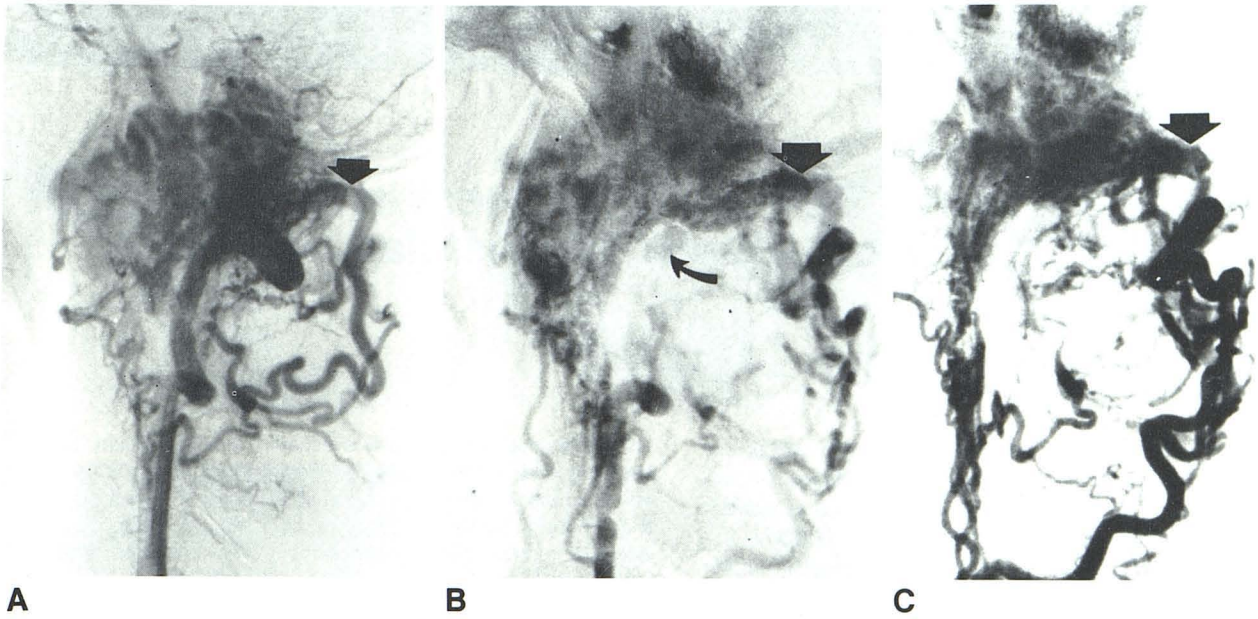

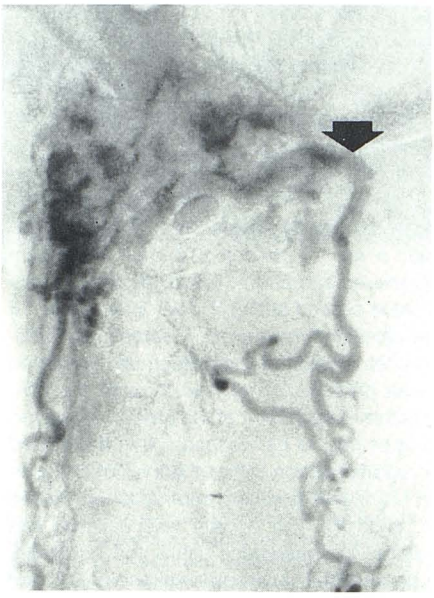

Fig. 5.—29-year-old man with progressive symptoms from residual/recurrent chemodectoma partly removed 4 years earlier. **A**, Right vertebral arteriogram after common carotid artery had been surgically occluded. Collateral flow via C2 and C3 collaterals to tumor mass via occipital artery (*arrow*). Right internal carotid artery filled via posterior communicating artery. Right vertebral artery over arch of C1 between posterior inferior cerebellar artery and most distal identified external carotid collateral was occluded with detachable balloon. Balloon was detached only after trial inflations were carried out without any resultant cerebral or cerebellar ischemia. **B**, Right subclavian artery arteriogram after detachable balloon occlusion (*curved arrow*) of right vertebral artery. Vertebral artery occlusion but abundant collaterals to tumor mass via cervical branches of thyro- and costocervical trunks (*straight arrow*). Ascending cervical artery arteriogram 24 hr after right vertebral occlusion. Abundant collaterals opacifying tumor primarily via occipital artery (*arrow*). **D**, Right subclavian artery arteriogram after PVA and IBCA embolization of ascending cervical artery. Vertebral artery occlusion and reduced tumor vascularity, with diminished reconstitution of occipital artery (*arrow*). Entire tumor was subsequently removed surgically.