Combined endovascular and open operative approach for mycotic carotid aneurysm

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Mycotic aneurysms of the extracranial carotid artery are rare and warrant surgical intervention. Management involves open and endovascular approaches. We report the case of a 67-year-old woman with an *Escherichia coli* soft-tissue infection of the right retropharyngeal space and subsequent mycotic carotid aneurysm and thrombosis of the internal jugular vein. The patient presented with a pulsatile mass and right middle cerebral artery stroke. Our surgical management involved coil embolization of the aneurysm to provide for vascular control, with resection of the common carotid artery, internal carotid artery, and extracranial carotid artery branches, along with the internal jugular vein. (J Vasc Surg 2010;51:1514-6.)

With modern antibiotics, mycotic aneurysms of the extracranial carotid artery have become sporadic and difficult to diagnose. A mycotic aneurysm can develop when dilation of the arterial wall occurs secondary to weakening by infection or when an existing aneurysm is seeded by a blood-borne infection. The most common isolated organisms in mycotic aneurysms are *Staphylococcus* spp.

Only one previous case report has documented an internal carotid mycotic aneurysm with associated thrombosis of the internal jugular vein.[1] We describe a mycotic carotid aneurysm in an elderly woman caused by *Escherichia coli*. Her case was complicated by a cerebral infarct in the distribution of the middle cerebral artery. Resolution of the combination of internal jugular vein thrombosis and the mycotic carotid artery aneurysm ultimately required endovascular embolization of the common carotid artery and surgical resection of the carotid artery and the internal jugular vein.

CASE REPORT

The patient, a 67-year-old Hispanic woman, had a history of hypertension and diabetes. She presented to another hospital with fever, progressive right-sided neck pain, and dysphagia of 2 weeks in duration, and lower-back pain of 1 week in duration. Pyelonephritis was discovered during the work-up for this initial presentation. Blood cultures grew *E coli* that was sensitive to piperacillin/tazobactam, ampicillin/sulfabactam, and the carbapenems. A computed tomography (CT) scan of the neck, without contrast, showed a pronounced soft-tissue density anterior to the right carotid artery that suggested an early inflammatory process. She was treated for the acute pyelonephritis and discharged with a 10-day course of amoxicillin.

The patient remained bed-ridden, with continued neck pain and fevers. She also stopped taking insulin at this time. Two weeks later, the patient again presented to the hospital for altered mental status. Her serum glucose level was >1200 mg/dL, and she was treated for diabetic ketoacidosis. Notably, blood cultures again grew *E coli,* and piperacillin/tazobactam was prescribed.

On day 3 of this hospitalization, dense left hemiplegia and facial droop were noted on examination. A CT scan of her head at this time showed a nonhemorrhagic right parietal infarct later developing into a large infarct of the right middle cerebral artery distribution. A rapidly evolving right-sided neck mass was also noted, with neck pain radiating to the temple and occipital area. The patient required emergency intubation for hypoxic respiratory failure. She became febrile, and vancomycin was added to the piperacillin/tazobactam. The patient was transferred to the medical intensive care unit at our hospital for higher-level care and surgical intervention.

On admission to our hospital, metronidazole was added to the vancomycin and piperacillin/tazobactam to provide anaerobic coverage. The right neck pain persisted, and the mass below the angle of the mandible was noted to be pulsatile. CT angiography of the head and neck revealed a right mid-to-lower neck abscess with significant soft-tissue infiltration and gas, as well as a mycotic aneurysm arising from the proximal cervical right internal carotid artery (Fig 1). There was also thrombosis of the entire course of the right internal jugular vein without intracranial involvement. Complete occlusion of the mid-to-distal cervical, petrous, and cavernous right internal carotid artery, presumably secondary to the mycotic aneurysm, was also noted. A follow-up carotid ultrasound scan showed a 5.3-cm mycotic aneurysm in the region of the carotid bulb. A transthoracic echocardiogram showed no evidence of vegetations on the heart valves.

The large mycotic aneurysm indicated the need for emergency surgical intervention, with débridement and drainage of the neck phlegmon. The patient was taken to the angiography suite before neck drainage for embolization of the right common carotid artery, providing vascular control. One 14-mm and one 12-mm Amplatzer vascular plug (AGA Medical Corporation, Plymouth, Minn) and two Tornado platinum coils (Cook Medical Inc, Bloomington, Ind) were deployed, which resulted in total throm-

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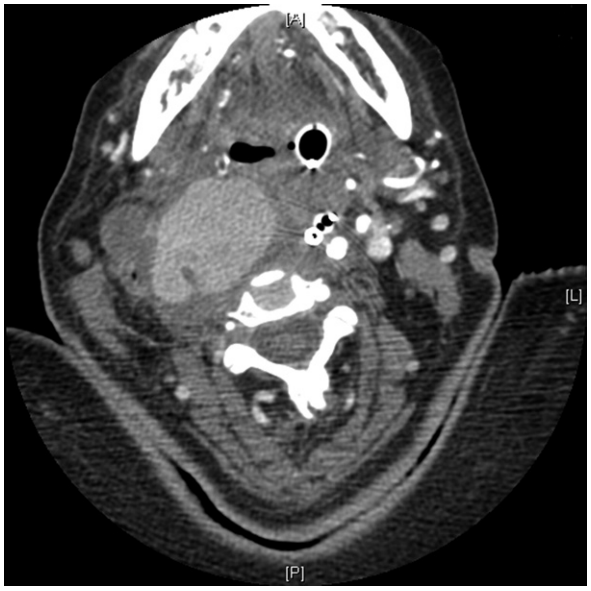

Fig 1. A computed tomography angiography shows a mycotic aneurysm at the right carotid bifurcation, with surrounding phlegmon.

bosis of the right carotid system and the common carotid artery, without any evidence of flow on selective injection (Fig 2).

The patient was then taken to the operating room for radical neck dissection and débridement, with assistance from a head and neck surgeon. The larynx and pharyngeal walls were remarkably edematous. The sternocleidomastoid was opened along the anterior border and reflected from the mass laterally. Dissection then proceeded medially to the omohyoid and then superiorly toward the medial aspect of the aneurysm. The retropharyngeal space was opened, and there was extensive pus and induration throughout the carotid sheath and parapharyngeal space from the skull base to the clavicle. A 5-cm thrombosed aneurysm was noted in the right internal carotid artery immediately adjacent to the carotid bifurcation.

Dissection continued posteriorly to the trapezius muscle; this was followed up to identify cranial nerve XI until the skull base. Cranial nerve XII was identified at the level of the digastric muscle and followed to the skull base. Cranial nerve X was also dissected out, but the nerve was tenuous.

The internal jugular vein was clamped and resected from the skull base to the clavicle. The necrotic and aneurysmal carotid artery was resected from the second branch of the external carotid artery and the internal carotid artery 2 cm above the hypoglossal nerve to 3 cm proximal to the bifurcation. The distal Amplatzer plug was removed. The proximal common carotid was noted to be nonnecrotic and was suture-ligated. The remaining vascular plug and coils were left in place.

Postoperatively, the patient continued to receive vancomycin, piperacillin/tazobactam, and metronidazole. She remained stable and afebrile, and her neurologic status improved. She was prescribed aspirin and heparin for the middle cerebral artery stroke. On postoperative day 3, intraoperative wound cultures revealed growth of extended-spectrum β-lactamase-resistant *E coli* that was sensitive to carbapenems. Her antibiotics were switched to meropenem, and her white blood cell count decreased from 17 to 12 × 10^9 cells/L on postoperative day 4.

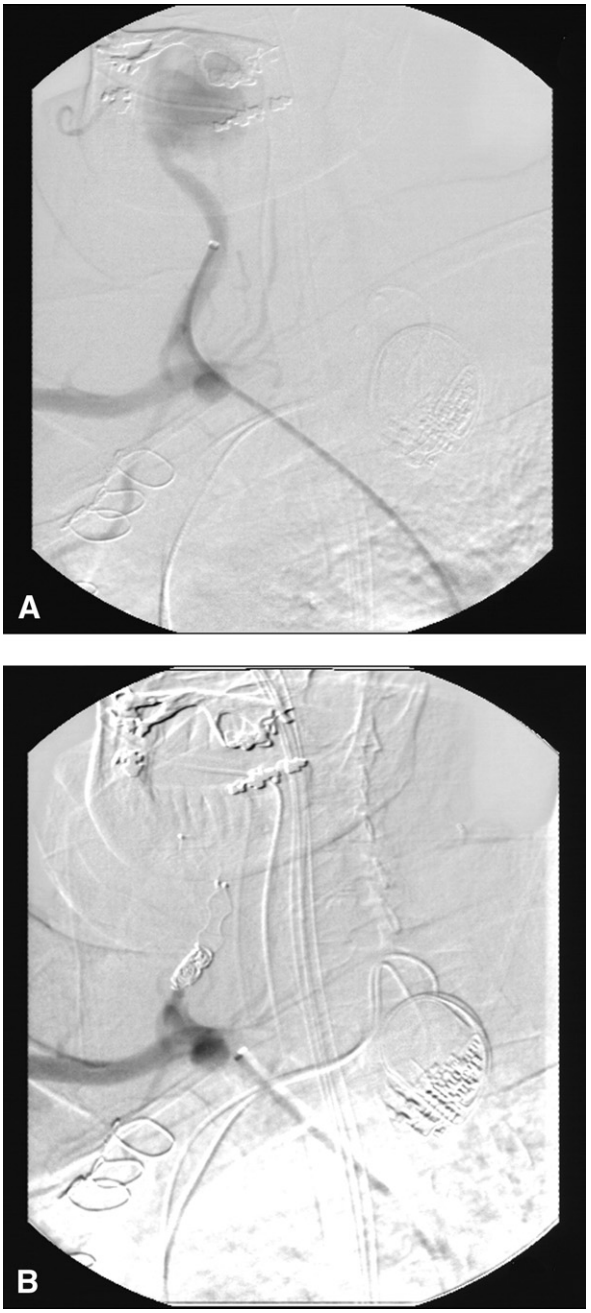

Fig 2. Intraoperative angiograms show **(A)** the right carotid artery before deployment of the vascular coils **(B)** and embolization of the aneurysm after the coils were deployed.

The patient had a prolonged hospital course due to respiratory compromise, and a tracheostomy and percutaneous endoscopic gastrostomy were performed before discharge for aspiration risk. She was discharged to the referring hospital with a 6-week course of meropenem and long-term prophylaxis with trimethoprim/sulfamethoxazole for the prosthetic coils that were placed in the

right carotid artery. The patient's course was stable until sepsis and multiorgan failure developed after a urinary tract infection. She died 14 months after discharge from our hospital.

DISCUSSION

Mycotic aneurysms of the carotid artery are particularly rare, occurring in only 0.9% of aneurysms overall.[2] One review of the literature from 1966 to 2000 revealed only 45 cases.[3] The most common frequent pathogen isolated is *Staphylococcus aureus.* More rarely, aneurysms caused *by Streptococcus, Salmonella, Klebsiella, Proteus mirabilis, Corynebacterium,* and *Yersinia enterolitica* have been reported, with only three previous reports of *E coli.*[4-6]

Because of the location of the carotid artery in the parapharyngeal space, the mycotic aneurysm most commonly presents as a growing, pulsatile cervical mass in the lateral aspect of the neck. Pain, tenderness, fever, dysphonia, and dysphagia may be associated with the aneurysm.[5] An untreated aneurysm may shower septic emboli to the brain or rupture, causing massive blood loss. Diagnosis typically is aided by duplex ultrasound imaging of the carotid artery or more invasively with arteriography.

Lemierre's syndrome consists of septic phlebitis of the internal jugular vein secondary to oropharyngeal infection due to *Fusobacterium necrophorum.*[7] Given the thrombosis of the internal jugular vein and infection of the retropharyngeal space in this patient, Lemierre's syndrome was considered. Although the patient had had an extraction of an infected tooth 2 months before presentation, direct spread of the oropharyngeal infection to the carotid seems unlikely because the cultured *E. coli* suggests hematogenous seeding subsequent to the septicemia. With the increasing prevalence of extended-spectrum β-lactamase-producing *E coli,* there are increasing reports of community-acquired urinary tract infections from this organism causing bloodstream infections,[8] with a similar case resulting in an extracranial carotid mycotic aneurysm.[9]

Surgical intervention is mandatory for mycotic extracranial carotid aneurysms. Open approaches include resection and interposition grafts, resection and patch angioplasty, or carotid ligation.[3,4,6] Endovascular repair of nonmycotic carotid aneurysms involves stent graft exclusion, stent placement with coil exclusion, and endovascular balloon exclusion.[10-12] The endovascular approach not only offers the advantage of avoiding difficult dissection and eliminating the needs for high cervical exposure and subsequent risk of cranial nerve injuries, but recent evidence suggests better outcome in cases of nonmycotic carotid aneurysms.[13]

However, endovascular approaches are not typically recommended for mycotic carotid aneurysms given the increased risk of using prosthetic material in the setting of infection. With a significant retropharyngeal infection, a purely endovascular approach was not possible for our patient. Thrombosis of the internal carotid artery precluded any attempts at bypass or recanalization. We therefore used an endovascular approach to secure proximal control in the massively edematous and indurated neck, followed by subsequent radical débridement. Although occlusion devices were left in situ in the proximal common carotid artery, no prosthetic infection or abscess developed in the thrombosed proximal common carotid artery in the weeks after the procedure.

CONCLUSIONS

Hybrid endovascular and open operative approaches such as those described in this case report offer definitive solutions to potentially life-threatening vascular catastrophes, such as rupture of mycotic carotid artery aneurysms with reduced surgical morbidity and operative risk.

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