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Ruptured Petrous Carotid Pseudoaneurysm Due to Tuberculous Otitis: Endovascular Treatment

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Summary

We report the imaging findings and endovascular treatment in an unusual case of petrous internal carotid artery pseudoaneurysm due to primary tuberculous otitis. The aneurysm was recognized and ruptured during a surgical intervention for otitis. Successful endovascular treatment of the aneurysm was performed by occlusion of the parent vessel using detachable balloon and coils.

Introduction

Tuberculosis of the temporal bone leading to internal carotid artery (ICA) pseudoaneurysm is extremely rare. It may go undetected and can have serious consequences for the patient. We present an intraoperative rupture of petrous ICA pseudoaneurysm believed to be associated with primary tuberculous otitis, and its interventional radiological management with endovascular trapping.

Case Report

A 61-year-old woman with right sided ear drainage for three years had hearing loss and dizziness for two months and facial paralysis for one month. Otorhinolaryngological examination revealed polyps protruding from perforated tympanic membrane and filling the right external ear canal. Audiometry revealed total sensorineural hearing loss. The remainder of the clinical examination was unremarkable except for enlarged right cervical lymph nodes. The patient denied a history of trauma and chest radiography was normal. CT of the temporal bone, performed in another center, showed a soft tissue mass obliterating the middle ear and mastoid, along with destruction of the petrous bone. Complicated chronic otitis media or tumoral processes were presumed and a surgical intervention was planned for the purpose of mastoidectomy, facial nerve decompression and biopsy. At surgery, a granulation tissue in the mastoid cavity, cheese-like softened bones, and involvement of the middle fossa dura mater were observed. The posterior canal wall was drilled and an open cavity was created. When the mucosa covering the facial canal near the oval window was elevated and extracted with a forceps, an abundant blood jet was seen unexpectedly. The bleeding was controlled with tampons filling the middle ear cavity. Subsequent endoscopic nasopharyngeal examination revealed no bleeding from the eustachian tube. Postoperative contrast enhanced CT after the clinical condition of the patient was stabilized, revealed an aneurysmal lesion measuring 2 cm in diameter adjacent to the right petrous carotid artery. The lesion was bulging into the middle ear laterally and extending to the pterygoid space inferiorly. The

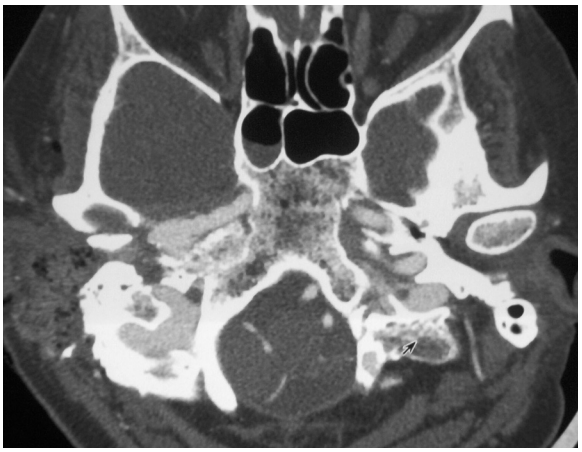

Figure 1 Postoperative contrast-enhanced axial CT scan at the level of temporal bones with bone window settings shows the aneurysm in the proximal portion of the petrous ICA. Note the bone erosion of the right carotid canal with irregularities of the intrapetrous ICA.

wall of the intrapetrous segment of the ICA was irregular. No hematoma or active extravasation was present (Figure 1). Conventional angiography revealed not only a bizarre pseudoaneurysmal lesion originating from the gene of the right petrous ICA, but also diffuse involvement of the whole petrous segment manifested as marked irregularities and mild fusiform dilatation (Figure 2). The imaging findings indicated that the isolation of the aneurysm from the carotid circulation preserving the parent artery would not be reliable. The left common carotid angiogram with simultaneous right carotid cervical compression demonstrated good collateral circulation from the anterior communicating artery toward the right intracranial carotid circulation. Therefore, a decision was made to treat the aneurysm by endovascular occlusion of both the lesion and the parent artery. A 7 French guiding catheter was positioned in the right cervical ICA. An attempt to pass the lesion with detachable balloon catheter (Goldvalve, Minvasys, France) failed, so the balloon occlusion test was performed in the proximal right ICA. The patient remained neurologically stable for 25 minutes during test occlusion, and then the balloon was withdrawn. Due to the difficulty in the passage of the balloon catheter through the aneurysmal segment safely, distal right ICA trapping was planned with the use of coils. An Excelsior microcatheter (Boston Scientific Target Therapeutics, Fremont, CA) was navigated distally into the aneurysm in the petrous ICA. Endosaccular coiling of the pseudoaneurysm and complete occlusion of the ICA were performed with detachable coils (Hydrocoil, Microvention, Inc, Aliso Viejo, CA) and fibered platinum coils (Boston Scientific Target Therapeutics, Fremont, CA). Subsequently, proximal ICA trapping was performed with the detachment of the same balloon below the aneurysm for safety. Final angiographic images showed total occlusion of the right ICA and the presence of crossover blood flow from the left ICA to the right anterior circulation (Figure 3). On the post-embolization period, the patient experienced transient left hemiparesis, which resolved spontaneously after hydration. No further bleeding was encountered. Radical mastoidectomy was completed with a second stage operation. Histopathologic analysis of the excised cervical lymph node and polypoid tissue from the ear showed granulomas with chronic inflammatory cells, epithelioid histiocytes, Langerhans' type giant cells, and large areas of caseous necrosis consistent with a diagnosis of tuberculosis. The patient was prescribed empiric antituberculosis treatment. During follow-up, the mastoid cavity was clean and she experienced no further symptoms, but facial paralysis persisted.

Discussion

Aneurysm formation within the petrous segment of the ICA is rare, and its true incidence is unknown [1]. The origin of petrous carotid aneurysms remains unclear, and most are considered to be congenital. A pseudoaneurysm, a blood-filled space contiguous to a vessel, develops when a fibrous tissue capsule forms in response to injury to all layers of an arterial wall. Such an injury may result from blunt or penetrating trauma, infections or inflammatory conditions. Tuberculous involvement of vessels is also known to cause aneurysms [2]. However the incidence of tuberculosis in the temporal bone is very low due to widespread use of antibiotics. There have only been sporadic reports of small case series in the literature [3,4], and we did not find any report mentioning primary tuberculous otitis leading to petrous carotid artery pseudoaneurysm and its endovascular treatment. In the case of Cross et Al [2], they present a

petrous carotid artery pseudoaneurysm projecting into the sphenoid sinus in a patient with miliary tuberculosis without otitis component.

The diagnosis of tuberculous otitis is often missed or made only after surgical treatment for otitis media. The clinical manifestations of tuberculous otitis media vary greatly, but the most common features are painless refractory otorrhea and hearing loss. In our patient, the diagnosis of tuberculous petrous carotid pseudoaneurysm was unsuspected until an unexpected gush of blood from the lesion was seen at surgery. High resolution CT is the best imaging modality available for identifying features suggestive of tuberculosis, the extent of disease, presence of complications and demonstration of anatomy prior to surgery. Although most cases presented with soft tissue density occupation of the tympanic cavity without bone erosion, CT evidence of widespread bone destruction without clinical signs of aggressive infection should suggest the diagnosis of a mycobacterial process [4]. The vascular involvement and the presence of a petrous carotid aneurysm may be demonstrated on contrast enhanced CT or MR images. Conventional angiography remains the reference standard for the diagnosis and plays a key role in the management of vascular lesions such as pseudoaneurysms. To our knowledge, the present aneurysm is unique because it developed secondary to tuberculous involvement of the neighboring bone and ruptured during a surgical intervention. Unfortunately, the preoperative unenhanced CT scan was insufficient to depict the pseudoaneurysm. Although there is no general agreement about the usefulness of CT in preoperative evaluation of chronic otitis media, contrast enhanced CT should be performed if a vascular involvement is suspected. Preoperative knowledge of this information can allow the surgeon to plan the surgical procedure more accurately to avoid potentially dangerous complications.

Treatment options for petrous ICA aneurysms include conservative management with imaging follow-up, endovascular balloon occlusion, endovascular coil placement or stent assisted coil insertion, placement of a flexible covered stent, or surgical trapping and revascularization with a high-flow bypass [1]. The selection and safety of treatment modality depend on the anatomy of the aneurysm and the segment involved as well as the presence of collateral flow to brain and the clinical status of the patient. Endovascular treatment alternatives, with preservation or sacrifice of the ICA, have become the most frequently used techniques to control an active hemorrhage or to prevent fu-

Figure 2 Right carotid digital subtraction angiogram shows the aneurysmal lesion originating from the genu of the right petrous ICA with lateral and inferior lobules. A mild fusiform dilatation of postaneurysmal ICA with marked irregularities indicating total involvement of the entire petrous segment is also seen.

Figure 3 Postembolization left carotid angiogram with AP projection shows crossover blood flow from the left to the right anterior circulation. Note the coils and the balloon on the right side.

ture bleeding [2,5,6,7]. Carotid pseudoaneurysms caused by infection carry a high risk of rupture with a 54% mortality rate [2]. The treatment for patients with a ruptured petrous carotid pseudoaneurysm tends to be more aggressive because of the higher risk of hemorrhage and distal thromboembolism. Since the parent artery was also involved and well-functioning communicating arteries were present, we determined that occlusion of the ICA proximal and distal to aneurysmal segment was the optimal procedure to prevent further bleeding. Endovascular occlusion of the ICA is usually performed by deployment of detachable balloons. Microcoils providing a rapid and permanent arterial occlusion can also be used to occlude the ICA. In our case, microcoils were chosen as the embolic agent for distal trapping because we believe that a guide-wire-directed microcatheter could be more safely and successfully positioned in the pseudoaneurysmal segment than a detachable balloon catheter.

Tuberculous otitis remains a significant diagnostic challenge for otorhinolaryngologists. The lack of dramatic symptoms in spite of radiologic findings of an aggressive bone-destroying lesion should arouse suspicion of the possibility of a tuberculous infection. If appropriate imaging is not available, the misinterpretation of its vascular complications can have devastating consequences. Management of ruptured petrous carotid artery aneurysms also remains a challenge, and an urgent treatment including endovascular strategies is recommended.

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