# Superficial Temporal Artery Pseudoaneurysm: Diagnosis and Preoperative Planning with CT Angiography

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**Case Report**

# Superficial Temporal Artery Pseudoaneurysm: Diagnosis and Preoperative Planning with CT Angiography

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**Summary: We report the use of CT angiography in the diagnosis and preoperative planning of a superficial temporal artery pseudoaneurysm. A 50-year-old man presented with a pulsatile preauricular mass 4 weeks after undergoing pterional craniotomy for aneurysm repair. CT angiography revealed a 2.5-cm pseudoaneurysm arising from the posterior margin of the right superficial temporal artery at the inferior margin of the craniotomy incision. To our knowledge, this is the first reported case showing the usefulness of CT angiography alone in the diagnosis and characterization of a superficial temporal artery pseudoaneurysm.**

Superficial temporal artery (STA) pseudoaneurysms are uncommon and usually are the result of trauma to the frontotemporal region. The appearance of a pulsatile preauricular mass chronologically related to trauma is highly suggestive of the diagnosis.

Imaging strategies to confirm the diagnosis include digital subtraction angiography, sonography, MR imaging, MR angiography, and CT. Digital subtraction angiography is the most commonly used imaging technique and is the criterion standard with which to evaluate the vessels of the head and neck. However, it carries a ≤5% overall complication rate, including a small risk of stroke (1). The development of CT angiography offers a minimally invasive alternative to digital subtraction angiography in the diagnosis and characterization of STA pseudoaneurysms.

## *Case History*

A 50-year-old man presented with acute subarachnoid hemorrhage. Cerebral angiography identified an anterior communicating artery aneurysm. A right pterional craniotomy was performed for aneurysm clipping. The patient recovered and was discharged to a rehabilitation center. Four weeks after surgery and during the course of 1 week, the patient developed a mass in the right temporal region. An examination revealed that the mass was pulsatile, firm, and nontender; it measured approximately 2.0 cm and was located along the inferior margin of the scalp incision. The patient did not complain of headache or pain and was neurologically stable.

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CT angiography was performed by using a multidetector GE Lightspeed scanner (General Electric Medical Systems, Milwaukee, WI). The axial source data were postprocessed with 2D multiplanar reformat and 3D volume-rendering algorithms (Vital Images, Plymouth, MN). CT angiography revealed a 2.1 × 2.3 × 2.5 cm oval pseudoaneurysm arising off the main trunk of the right STA (Fig 1A–C). The STA distal to the origin of the pseudoaneurysm coursed along the ventral surface of the pseudoaneurysm and continued on as the frontal branch. The pseudoaneurysm was immediately superior to the posterior margin of the zygomatic arch and approximately 1 cm superior to the external auditory canal. The parietal branch of the STA was not visualized. A small branch 2 cm posterosuperior to the dome of the pseudoaneurysm was identified and was thought to represent a small collateralized parietal branch. The transverse facial artery arose off the proximal trunk of the STA, remote from the pseudoaneurysm. The central portion of the pseudoaneurysm enhanced (1.2 × 1.5 × 1.7 cm). No CT angiographic evidence for a fistula was noted.

Based on the CT angiographic findings, the patient underwent surgical exploration of the right temporal region. At surgery, a pseudoaneurysm was identified arising from the posterior margin of the main trunk of the STA, immediately distal to the zygomatic arch (Fig 1D). A clear dissection plane was found between the pseudoaneurysm and the ventrally positioned main STA and frontal branch. The parietal branch was not identified. The STA was ligated proximally and distally, and the pseudoaneurysm was excised. The findings of a pathologic examination were consistent with a partially thrombosed STA pseudoaneurysm located adjacent to a normal appearing artery. Elastic Van Gieson stain showed internal and external elastic lamina within the normal artery but failed to show any elastic fibers in the wall of the aneurysm, confirming the diagnosis of pseudoaneurysm (Fig 1E).

## Discussion

STA pseudoaneurysms are uncommon, with approximately 200 cases reported in the literature (2, 3). The first recorded case of an STA pseudoaneurysm was in 1740 by Bartholin and was secondary to blunt trauma (4). Most STA pseudoaneurysms are secondary to trauma, although the type of trauma has evolved over time (3–5). In the 1800s, the major causes of STA pseudoaneurysms were dueling with swords and bloodletting. Present day causes are categorized as incidental trauma and iatrogenic injury. Sports-related incidental trauma includes injury resulting from hockey, rugby, squash, baseball, basketball, and paintball. Non-sports-related trauma includes injury resulting from gunshot wounds, assault and battery, and car accidents. STA pseudoaneurysms due to iatrogenic injury have been reported to occur after cyst removal, temporomandibular joint excision

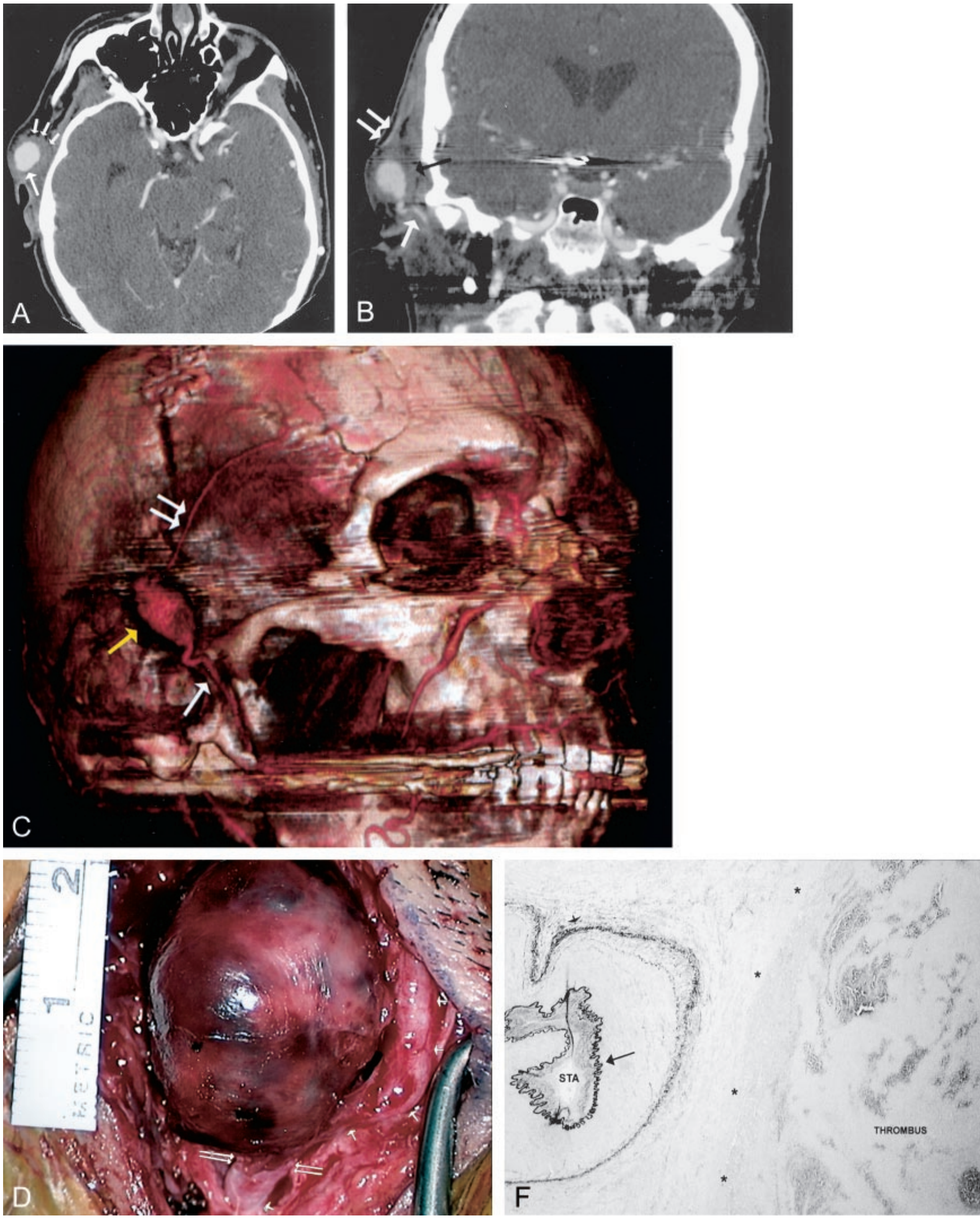


FIG 1. Images from the case of a 50-year-old man who presented with a pulsatile preauricular mass 4 weeks after undergoing pterional craniotomy for aneurysm repair.

*A*, Axial 2.5-mm source CT angiogram shows the inner enhancing component (*single white arrow*) of the STA pseudoaneurysm. The surrounding soft tissue attenuation (*triple white arrows*) represents peripheral thrombus and adjacent inflammatory change.

*B*, Coronal oblique 2D reformat CT angiogram shows the relationship of the main trunk of the STA (*single white arrow*) to the pseudoaneurysm (*black arrow*). The frontal branch of the STA (*double white arrows*) is seen superior to the pseudoaneurysm.

*C*, 3D volume-rendered CT angiogram depicts the main trunk of the STA (*single white arrow*), the STA pseudoaneurysm (*yellow arrow*), and the frontal branch of the STA (*double white arrows*). Note the relationship of the pseudoaneurysm to the zygomatic arch. The STA ventral to the pseudoaneurysm is difficult to distinguish from the enhanced component of the pseudoaneurysm.

*D*, Intraoperative digital photograph shows the STA pseudoaneurysm. Note the normal STA (*short white arrows*), ventral to the pseudoaneurysm. A small tear in the main trunk of the STA (*double white arrows*) was the origin of the pseudoaneurysm.

*E*, Elastic Van Gieson stain (original magnification, ×20). The dark staining internal (*black arrow*) and external (*black arrowhead*) elastic laminae are seen in the normal STA. The absence of elastic fibers in the wall (*asterisks*) of the organized thrombus confirmed the diagnosis of pseudoaneurysm.

arthroplasty, punch hair grafting, and craniotomies. Most STA pseudoaneurysms are solitary, although multiple pseudoaneurysms occurring after craniotomy in a hemophiliac patient has been reported (6). True aneurysms of the STA have been reported but are distinctly uncommon (4).

The clinical diagnosis of an STA pseudoaneurysm is based on a history of trauma or surgery to the temporal region and subsequent development of a preauricular pulsatile mass. Most patients present within 2 to 6 weeks of injury, whereas 15% to 20% present 6 months to 3 years after initial injury (7). Common presenting symptoms include a solitary painless mass in the preauricular region accompanied by pulsations, headache, or ear discomfort. Less frequent complaints include pain, visual disturbance, dizziness, hemorrhage, and cosmetic defect. A physical examination typically identifies a firm, nontender, pulsatile mass. Auscultation may reveal arterial pulsations and a systolic thrill.

The primary differential diagnosis of a pulsatile preauricular scalp mass occurring after incidental or iatrogenic injury includes STA pseudoaneurysm and STA AVF (5, 8). Pseudoaneurysms are extra-arterial hematomas that remain in communication with the arterial lumen. As the hematoma and thrombotic elements are reabsorbed, arterial blood can recirculate in the resulting cavity. An AVF forms when the vaso-vasorum is damaged, leading to arterial wall necrosis and abnormal vascular endothelial proliferation to an adjacent vein. STA pseudoaneurysms often have arterial pulsations and thrills corresponding to systole, whereas AVF have a continuous thrill and a bruit (4). The degree of pulsatility can depend on the amount of thrombus within the pseudoaneurysm. Although manual compression of the STA proximal to a pseudoaneurysm or AVF may eliminate its pulsations and thus narrow the differential, imaging is still necessary to differentiate between these and other causes.

Additional differential considerations include an aneurysm of the middle meningeal artery with erosion of the temporal bone, hematoma, abscess, inflammatory lesion, epidermal inclusion cyst, angiofibroma, meningocele, encephalocele, pseudomeningocele, parotid mass, and lipoma (3–5). The natural history of untreated STA pseudoaneurysms is not well documented; however, spontaneous rupture has been reported (7). Surgical indications include pain, cosmetic deformity, and the potential for rupture (5). Although embolization, balloon occlusion, and conservative management with prolonged manual compression have been used to treat this lesion, surgical excision is preferred because scalp lesions are readily assessable, few complications result, and recovery is swift.

Imaging strategies in the assessment of probable STA pseudoaneurysms include sonography, CT, MR imaging, and digital subtraction angiography. In one review of 35 cases, >90% underwent radiologic examination. Of those, >50% underwent digital subtraction angiography to verify the aneurysm and characterize the afferent and efferent vessels (7). Although digital subtraction angiography is the criterion-standard examination, it is an invasive procedure with a small but definite risk of stroke (1). Additionally, digital subtraction angiography will characterize only the patent component of the pseudoaneurysm, which can lead to an underestimation of lumen size depending on the degree of thrombus within the aneurysm. In giant pseudoaneurysms (>2.5 cm), partial thrombosis of an STA pseudoaneurysm is common (9). When a pseudoaneurysm is completely thrombosed, digital subtraction angiography can fail to help make the diagnosis (10). Direct percutaneous puncture of an STA pseudoaneurysm or the frontal branch of the STA has been reported (8). Although the risks of this approach are fewer than with traditional digital subtraction angiography, evaluation of the proximal STA is limited. Sonography has been used to assess STA pseudoaneurysms and can reveal an echogenic mass with arterial waveforms (11). Sonography is a noninvasive technique, but it provides little information about the adjacent soft tissues and osseous structures and would be less specific in the setting of a partially or completely thrombosed pseudoaneurysm. MR angiography is a noninvasive but expensive imaging strategy that can highlight the soft tissue abnormality and its relationship to the adjacent soft tissues. Turbulent flow within a pseudoaneurysm could result in intervoxel dephasing, which could underestimate the size of the lesion or overestimate the amount of thrombosis. Also, the STA vessels are 1 to 2 mm in size, which approaches the lower limits of MR angiographic resolution.

CT angiography is a minimally invasive technique that has evolved simultaneously with advances in CT technology, including slip ring design and multi-detector systems. Postprocessing software is robust and includes 2D and 3D assessment in an infinite number of planes. The examination requires a peripheral IV line, 75 cc of iodinated contrast material, 10 minutes of scanning time, and 10 minutes of postprocessing time. CT angiography can assess the patency and position of the main trunk and distal branches of the STA, including the transverse facial, frontal, and parietal branches. The true size of the pseudoaneurysm is accurately depicted with CT angiography, including the degree of thrombosis versus the amount of luminal opacification. The adjacent calvaria is easily assessed for fractures and any potential communication with the intracranial compartment. The relationship of the pseudoaneurysm and osseous landmarks, such as the external auditory canal and the zygomatic arch, are well shown. Based on location, attenuation, and enhancement, CT angiography can distinguish an STA pseudoaneurysm. A hematoma with referred pulsations versus a completely thrombosed STA pseudoaneurysm could present a diagnostic dilemma. Digital subtraction angiography has been recommended by others to distinguish an STA pseudoaneurysm from an AVF (5, 8). We have had anecdotal experience identifying asymmetric, early venous filling as a CT angiographic sign of a fistula (carotid cavernous fistula, dural AVF) and submit that the lack of this finding can argue against the presence of a fistula.

The current case showed the ability of CT angiography to accurately depict the morphology of an STA pseudoaneurysm. The degree of luminal patency versus peripheral thrombosis was established. The relationship of the main trunk of the STA and the frontal branch to the pseudoaneurysm was easily depicted. Partial visualization of the smaller parietal branch suggested proximal occlusion at the level of the pseudoaneurysm with collateralization distally. The position of the pseudoaneurysm relative to the external auditory canal and zygomatic arch were depicted. There was no evidence for asymmetric early venous drainage to suggest a fistula. Because of the definite risk of transient or permanent neurologic deficits associated with digital subtraction angiography, a less invasive study, such as CT angiography, is desirable. Ishikawa et al (9) reported the use of 3D CT in combination with digital subtraction angiography to characterize a giant STA pseudoaneurysm and recommended a combined imaging approach (3D CT or sonography with digital subtraction angiography) in such a clinical scenario. In the current case, CT angiography alone confirmed the diagnosis, provided important anatomic information to the neurosurgeon before surgery, and eliminated the risks associated with digital subtraction angiography.

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