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CASE REPORT

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Post traumatic superficial temporal artery pseudoaneurysm: Case observation

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Abstract

Aims: *Superficial temporal artery pseudoaneurysms (STAP) present as lumps or swellings at the temporal region, which appear in immediate or delayed time after trauma. The diagnosis is intuitively simple based on the unique appearance with several differential diagnoses. The operative management had been predominantly performed according to pieces of literature although conservative management might be assumed more applicable. Therefore, we sought the guideline for STAP management.*

Methods: *We observed a 47 year-old-male patient with two STAPs until the lumps disappeared. We reviewed the literature of which contents are including the STAP managements.*

Results: *The patient's STAPs were both located on the right temporal scalp. The initial size of the larger lump was measured 1.5x1.8cm and 0.3cm in height and the smaller lump was 0.8x0.8cm and 0.2cm in height. Being only as a cosmetic annoyance, the lumps were left untreated and observed in 7 months, which disappeared completely. Reviewing the literature, the STAP outcomes are often benign, i.e., mostly being cosmetic defects without serious complications. The worst outcome is bleeding from the ruptured site. The authors found that non-operative managements were applied to STAPs smaller than 1.5cmx1.8cm based on the works of literature and our case. Operative managements were applied to STAP with pain, rapidly increasing in size, persistent headache, paresthesia, uncomfortable feeling, and sometimes cosmetic purpose.*

Conclusions: *Not all STAP need to be managed operatively, especially when the lesion, due to its size and symptoms, doesn't affect the quality of life. Being benign in prognosis, conservative managements are enough in most cases. Nevertheless, it needs to be carefully observed and evaluated at a certain time before considering a surgical approach.*

Keywords: *pseudoaneurysms; false aneurysm; superficial temporal artery; STAP; head trauma*

Introduction

Superficial temporal artery pseudoaneurysms (STAP) are presented as pulsatile lump or swelling, in the frontotemporal region usually resulted from trauma, usually painless, may increase in size, or sometimes with neuropathic changes [1-5]. They sometimes present an ominous appearance that looks like devil horns (Figure 1). There will be a diminution or disappearance of pulsation on compression of the proximal area of the superficial temporal artery (STA). The mass is usually single, although it can be multiple in some patients [4,6]. In some cases, some presenting symptoms also can be associated, such as throbbing headache, dizziness, ear discomfort, facial pain, or facial palsy due to seventh cranial nerve compression [1,2,4,5,7,8].

Anatomically, STA is a terminal branch of the external carotid artery which supplies the skin and muscles on the scalp and face, the parotid gland, and the temporomandibular joint.9The STA forms numerous anastomoses with the supraorbital and supratrochlear arteries, also with the middle and deep temporal artery [10]. Because of its superficial and anatomical course, among facial vasculature, the STA is vulnerable to blunt head trauma, which can eventually result in traumatic aneurysm of the STA [2,3]. The STA located superficially over the frontal bone with a minimum "cushion" protection provided by thin temporalis and frontalis muscle. In some regions between, the artery even lies directly over the skull. Most traumatic swelling of STA aneurysms involves the anterior branch rather than the posterior or proximal branch since the anterior branch is the most unprotected course thus making it the most vulnerable [1,6,8].

When STA is exposed to trauma, the arterial wall is injured, blood flows out to form a hematoma within a pseudocapsule featuring pseudoaneurysm. Histologically, most traumatic swelling of STA aneurysm exhibits the features of pseudoaneurysm,11which is not surrounded by all the 3 layers of the arterial wall.

Thomas Bartholin described a STAP for the first time in 1740, and since then, 200-400 cases have been reported in the literature [1,2,4,411]. Over 80% of STAP cases occur in men, 75% are due to blunt trauma, and most patients present within two to six weeks of injury [12,13]. Most of cases revealed as occur in men may be related relatively to their activity tendency on daily basis, choice of works, and sports activities [6].

STAP can be managed by operative and non-operative method however there is no clear guidelines has been determined for the choice of management. Clear diagnosis and thorough evaluation of the symptoms should be made to make proper management.

The purpose of this paper is to present our case of STAP which was managed by the non-operative method. We conducted follow-up time to time and observed the STAP being resolved by time without surgical intervention.

Case report

A 47-year-old male visited our clinic with 2 lumps presented on the right temporal area of his head. The larger lump presented an ominous appearance that looked like devil horns (Figure 1). 2 months before, he was riding a bicycle, fell, hit the ground on the right side of his head, and then being treated at a hospital. On the examination, there were no signs of injury, and the CT scan was normal.

2 months after the incident, painless lumps evolved on his right temporal with the feel of pulsations, which brought him to our clinic to be examined. No headache, no hearing & visual disturbances, no dizziness, and no neurologic defect presented in symptoms.

Local physical examination revealed two non-inflammatory pulsatile lumps. The larger lump (STAP-1) at a frontotemporal region with size 1.5x1.8cm and 0.3cm in height (Figure 2A), and the smaller lump (STAP-2) revealed on the same side, located upper region of the right ear, with size 0.8x0.8cm and 0.2cm in height (Figure 2A). The pulsations were diminished on proximal STA compression, which is consistent with STAP. The color-Doppler of the pseudoaneurysm showed a "yin-yang" sign (Figure 3), thus confirmed the diagnosis of STAP.

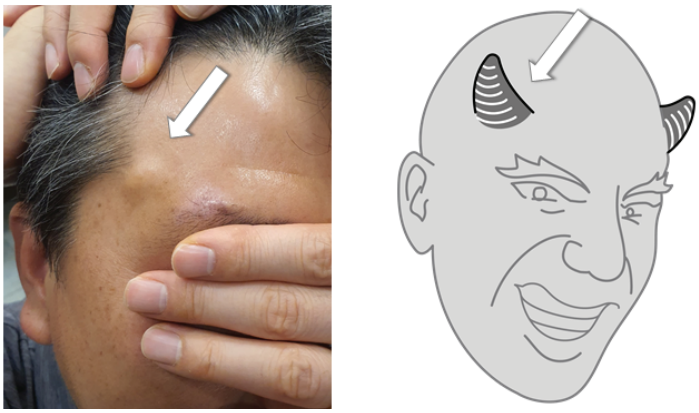

Figure 1: Outside appearance of STAPs. *The patient's larger lump presented ominous appearance that looks like devil horn.*

Figure 2: Clinical presentation of patient' STAPs. *(A) The larger lump at frontotemporal region (STAP-1) was measured about 1.5 x 1.8 cm and 0.3 cm in height. The smaller lump (STAP-2) was measure about 0.8 x 0.8 cm and 0.2 cm in height. (B) 3.5 months after the blunt head trauma. The size of the STAP-1 was visibly decreased, with size 1.2 x 1.5 cm and 0.3 cm in height. The size of the STAP-2 was remained the same, very slightly visible, and palpable.*

His blood test revealed normal C-reactive protein (CRP) as 1 mg/L, and erythrocyte sedimentation rate (ESR) was not tested because it was unavailable in our clinic. In this case, the diagnosis of temporal arteritis (TA) is less likely because the CRP was normal which indicated that the lesion was not caused by inflammatory conditions, and the appearance of the lesion was different. The patient experienced no uncomfortable feeling, did not bother by the cosmesis appearance, and refused any medical and surgical intervention, which is why we decided to conduct observation and waited while we evaluate the size, symptoms, and any changes in the follow-up.

The next follow-up was undertaken in November 2020, 1.5 months after his first visit. The size of the STAP-1 was visibly decreased (Figure 2B), with sizes 1.2 x 1.5 cm and 0.3 cm in height, while the size of the STAP-2 was remained the same (Figure 2B). The patient stated the same, that he didn't experience any uncomfortable feeling, no headache, no other symptoms except the existence of the lumps themselves which did not affect his quality of life.

The most recent follow-up was undertaken by a phone call in April 2021, 7 months after his first visit, in which he stated that both STAPs have visually and palpably disappeared.

Discussion

An aneurysm is classified as true, false, and dissecting. A true aneurysm involved all 3 layers of the arterial wall while a false aneurysm (pseudoaneurysm) is a collection of blood that oozes out of any blood vessel but is confined next to the vessel by adjacent tissue [2]. Thus, in the other hand, a pseudoaneurysm is defined as one in which the lumen is not surrounded by all the 3 layers of arterial wall [4]. Dissections are caused mostly by stretching and tearing of arteries, which leads to bleeding within the arterial wall. The dissection of the subadventitial area leads to the formation of aneurysms and pseudoaneurysms [14].

The majority of the aneurysm cases are true aneurysms while pseudoaneurysm account only for 1% of all aneurysms [2,15]. However, among the aneurysms of STA, the majority are pseudoaneurysms [16] with more than 75% of STAPs resulting from the blunt trauma to the head [2,5,8] including various sports-related injuries, skull fractures, and accidents [5]. Other STAP cases also occur from iatrogenic causes such as penetrating scalp

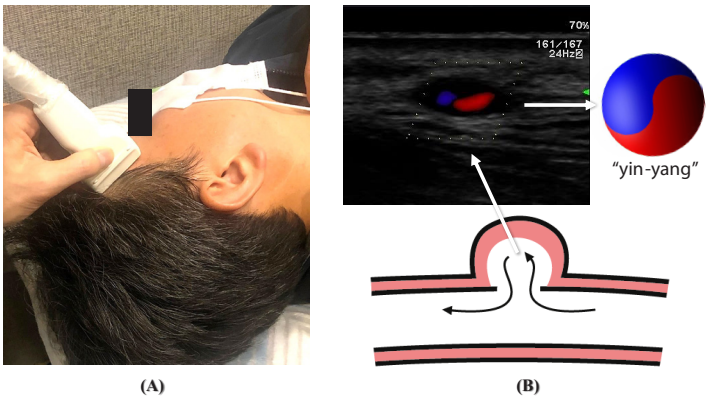

Figure 3: *(A) Ultrasound examination for STAP. Doppler ultrasound was performed to evaluate and confirm the diagnosis of STAP. (B) Yin-yang sign. The direct blood flow communication between arterial lumen and the STAP causing a swirling blood flow pattern and giving "yin-yang" sign in the pseudoaneurysm which is shown on the color-Doppler aspect. The blood flow entering the pseudoaneurysm cavity is shown as red on the screen, and the flow leaving the cavity is shown as blue.*

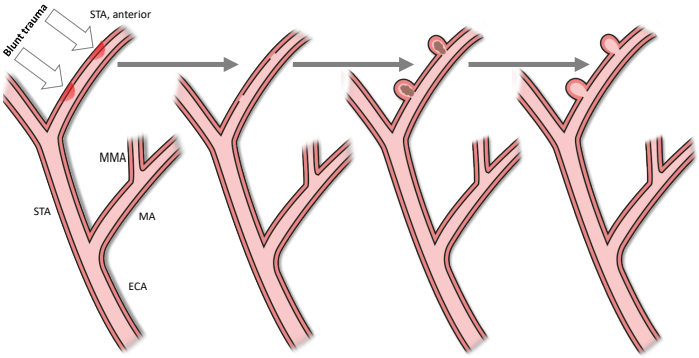

Figure 4: Formation of pseudoaneurysm of STA. *(A) Blunt trauma injures the arterial wall and induces necrosis. (B) Arterial intima and media are disrupted. (C) The extravasation of blood dissects the surrounding tissues, forms hematoma encapsulated by only the arterial adventitia or subcutaneous tissue. (D) A fibrous pseudocapsule then replaces the arterial wall, forms an aneurysm sac, and the liquefied hematoma is recanalized.*

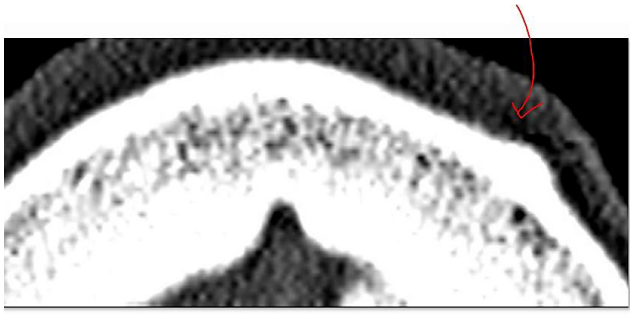

Figure 5: *A dense sclerotic lesion shown on CT scan suggested osteoma arises from the outer table.*

lesions (after penetrating injury to the scalp), previous craniotomy, post-Gardner traction, pin-type head-holder devices, hair implants, and post-injection of botulinum toxin [2,8,11]. Spontaneous pseudoaneurysms are very rare but can occur due to any congenital defect or atherosclerotic disease [2,11].

The mechanism of pseudoaneurysm formation is as follows: an arterial wall is injured during trauma, blood flows out to form a hematoma within pseudocapsule [1,2], which slowly expands from the pressure exerted by local blood flow.2This slow expansion of hematoma explains the frequently reported gap between the traumatic event and the onset of the mass [2,3] (Figure 4). The lack of resistance of the surrounding tissue in the superficial temporal region causes the appearance of a growing pulsatile mass [1,6]. Most of pseudoaneurysm tends to present 2 to 6 weeks following the initial injury but the reported time between trauma and the diagnosis is ranged from just a few hours to as long as 10 years [1,15].

The diagnosis is verified through the physical examination on compression of the proximal STA by pulsation disappearance [6,8]. The simple clinical test resulting in decrease or elimination of pulsation in the mass will differentiate between a STAP and vascular tumor or an aneurysm of the middle meningeal artery [6].

However, if there is any doubt, imaging is necessary to confirm the diagnosis. The main successful imaging modality of choice is sonography [8,13,17]. Sonography with color-Doppler (duplex) is a non-invasive technique with high sensitivity and specificity and is considered the gold standard [1]. It is a simple, quick, readily available, and portable modality that confers no risk of ionizing radiation does not require contrast use and confers clear benefits for the patient over other imaging modalities.7Sonography permits to define the anatomical presentation of the STAP, and the color-Doppler signal allowed to demonstrate a swirling or disorganized pattern of blood flow within the mass, described as a "yin-yang" sign[18,19], which referring to the symbol of the Chinese concept of how seemingly opposing forces are interconnected and interdependent in the natural world, giving rise to each other in turn [19]. Red represents the blood flow entering the pseudoaneurysm cavity while blue represents blood flow leaving the cavity [19].

The other imaging studies can include CT, MR, and digital subtraction angiography (DSA). CT scans of the head are required only when associated abnormalities are present [6]. CT and MRI may be useful to see associated intracranial trauma but are not suggested for first-line imaging. Definitive diagnosis can be made by angiography, but, as this is an invasive test, it should be reserved for diagnosis of difficult cases [17]. The risk/benefit of obtaining any imaging studies should be discussed and determined in all cases and justified as per Royal College of Radiology and Ionizing Radiation (Medical Exposure) Regulations [7].

The differential diagnosis of STAP includes any kind of masses appearing on the temporal or nearby area of the scalp, which can be classified into 2 groups.

The first group of STAP' differential diagnosis is based on vascular abnormalities, which include hematoma, arteriovenous fistula and malformation [1,6-8,20], vascular tumor [6,8], thrombosed pseudoaneurysm [7], angiofibroma [20], middle meningeal artery (MMA) aneurysms [21,22], and inflammation lesion such as TA [23].

The MMA is located inside the skull and may erode the temporal bone thus mimic the STAP [21,22]. The MMA in most individuals arises from the maxillary branch of the external carotid artery (ECA) and enter the skulls through the foramen spinosum to supply the dura and adjacent calvarium [24]. True aneurysms of the MMA are described to be associated with increased hemodynamic stresses caused by a variety of intracranial pathological conditions such as Paget's disease, moyamoya disease, arterial occlusion, and dural AVFs [25]. Pseudoaneurysms of the MMA are usually associated with fractures of the skull in the temporal region, can be formed at the fracture's site or at the weakest part of the vessel wall [26,27].

STAP reminds many neurologists of TA as a differential diagnosis because the term "temporal arteritis" suggesting strong relation to the temporal artery. However, TA is far too widespread in its distribution for just "temporal" [28]. Therefore, using the term "temporal arteritis" should be discouraged and it is best to use the term "giant-cell arteritis (GCA)" [28].

One study included 187 patients with GCA in large vessels showed that the most frequently affected arteries were subclavian (42%, 52 patients), axillary (32%, 39 patients), and thoracic aorta (20%, 24 patients) [29]. Apart from STA and the larger arteries, other arteries mentioned to be involved are from ECA branches such as: occipital, facial, parietal, and posterior auricular, and extremity arteries branches such as radial and dorsalis pedis. The STA in GCA usually appears as tortuous nodular cords covered by red, inflamed skin. In the early stages, pulsation is still palpable, but this is usually lost during the height of the disease. The hard, cordlike texture is probably due to a filling of the lumen by intimal proliferation rather than by clot [28]. Ocular complication in GCA may be explained by the vascular continuity between the temporal and ophthalmic arteries via the lachrymal branch of the former,

but since the disease is, in fact, widespread and involves many vessels, it is unnecessary to postulate vascular continuity [28]. As serologic markers for GCA, elevated CRP and elevated ESR provided a sensitivity of 86.9% and 84.1% respectively. Therefore, CRP is a more sensitive marker than ESR for a positive temporal artery biopsy that is diagnostic of temporal arteritis [30].

The second differential diagnosis group includes other kinds of masses such as abscess, lipoma [1,7,8,20], epidermal inclusion cyst, inflammatory lesions/inflammatory lymph node [1,20], soft tissue tumor, neuroma, foreign body granuloma, meningocele/pseudomeningocele, encephalocele, parotid mass [20], and also osteoma of calvarium (Figure 5). Trauma is one of several factors which can cause the development of osteoma [31]. Osteoma is the most frequent benign bone tumor of the adult skull, which usually arises from the outer table and only rarely from the inner table [32]. This juxtacortical lesion develops mainly of the frontal or parietal bone [33] and can be seen in all parts of the temporal bone [31]. It may manifest as a solitary painless mass [32] and predominantly asymptomatic [31].

Managements of STAP include nonoperative and operative procedures. Nonoperative methods included observation and application of continuous pressure over the pseudoaneurysm with eventual thrombosis. STAP with sizes as small as 1.3 cm had been reported to be treated with surgical management. However, we present that small-size (as small as 1.5 cm x 1.8 cm such as in our case) and painless STAP with none or minimal surrounding tissue damages can be managed conservatively without surgical or other intervention, especially when the presence of the lesion does not harm the quality of patient's life.

Operative methods for STAP include ligation of the common carotid artery, ligation of the external carotid artery, or more conventionally, proximal, and distal ligation of the pseudoaneurysm followed by excision [3-6]. Endovascular treatment modalities such as thrombin injection and catheter-based embolization has been described in few cases. This technique can be used in which surgery is not possible or not preferred for cosmetic reasons [3]. Surgical resection is the most popular procedure in the pieces of literature. Most cases which admitted to surgery management are based on certain indications and purposes such as cosmetic, pain, rapidly increasing in size, persistent headache, paresthesia, uncomfortable feeling, and daily activities disturbances (feel uneasy, uncomfortable to sleep over the area, etc.), and the changes of overlying skin or adjacent structures as reported on literatures [1,2,8,12,15,20].

Al-Mamori et al. [15], reported a case with an observation approach due to the small size of STAP (1 x 1 cm). Conservative management with analgesics and monthly-based examination is done. Pane TA reported a case with lump size of 1.3 cm which treated by resection and ligation. The patient made an uneventful recovery [21]. Manuel et al. [13] reported 2 cases, a case with lump size 0.5 x 0.5 cm, in which the patient was apprehensive about surgery and other interventional radiological procedures, hence it was decided to apply conservative management of continuous pressure. The mass was gradually reduced in size and had resolved completely by the end of 5 weeks. The other case was reported with lump size 2 x 1.5 cm and was excised under general anesthesia. Kim et al. [34] reported a review of 11 patients who underwent different management. 7 cases treated by surgical resection (1 case among it was reported with mass size 1.5 cm), 2 cases by conservative treatment (1 case among it was reported with mass size 1 x 1 cm), 2 cases by thrombin injection, and 1 case with radiology intervention. No recurrence during the follow-up periods.

Every method has advantages and disadvantages, should be chosen according to the chronicity and size of the pseudoaneurysm, clinical status, hemodynamic stability, patient's aesthetic preferences, and compliance [34].

Conclusion

Despite the ominous appearance that looks like devil horns, the outcome is benign, i.e., mostly being a cosmetic defect without serious complications. The worst outcome is bleeding from the ruptured site. Therefore, not all STAP need to be managed aggressively, especially when the lesion, due to its size and symptoms, doesn't affect the quality of life. It needed to be carefully observed and evaluated at a certain time before considering a surgical approach.

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