Pseudo-Aneurysm in Internal Maxillary Artery Caused by Radiofrequency Ablation: Literature Review with a Case Report

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Received May 13, 2020

Revised May 26, 2020

Accepted May 27, 2020

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This work was supported by the Yonsei
University Wonju Campus Future-Leading
Research Initiative of 2020 (2020-52-
0063).

The case of pseudo-aneurysm of internal maxillary artery (IMA) in oral and maxillofacial region is known to be very rare. The etiology of this case was regarded as IMA injury by radiofrequency ablation (RFA) and such incidence was not reported previously. One case of false aneurysm in the IMA was referred from local dental clinic to our department. Left facial swelling was observed with severe trismus immediately after radiofrequency procedure for masseteric nerve block in local dental clinic. Despite of medication and surgical intervention, the swelling did not subside and there was massive bleeding and pulsation on one of the follow ups. The traumatic vascular disorder was suspected and finally diagnosed with angiography and treated by embolization procedure. RFA targeting masseteric nerve or trigeminal ganglion may cause traumatic injury to adjacent anatomic structures such as IMA, resulting in pseudo-aneurysm. Clinicians must be aware of potential damages of RFA. Angiography enables the solid diagnosis for pseudo-aneurysm, and selective embolization can be optimum treatment method.

Key Words: Embolization; Pseudoaneurysm; Radiofrequency ablation

INTRODUCTION

An arterial aneurysm is defined as a focal dilation of a blood vessel with respect to the original artery [1]. A pseudo-aneurysm or traumatic arterio-venous fistula can be formed as a result of arterial wall dehiscence caused by blunt trauma and penetrating trauma. In the past, most of the pseudo-aneurysms were reported as a result of knife wound, gunshot wound, or adjacent bone fractures [2-4]. However, nowadays some reports reveal pseudo-aneurysm caused by therapeutic radiofrequency ablation (RFA). Recently some reports have introduced pseudo-aneurysms of various etiologies in oral and maxillofacial region, but only one of them was caused by RFA [5]. We experienced previously unreported case of the patient with internal maxillary artery (IMA) pseudo-aneurysm presumably

occurred by RFA on masseteric nerve. We hereby report a case on the etiology, symptoms and treatment.

CASE REPORT

A 44-year-old woman visited Department of Emergency with left facial swelling and spontaneous pain. The medical history revealed that she underwent masseteric nerve block therapy due to chronic temporo-mandibular disorder 10 days before the visit. The patient explained that facial swelling appeared immediately after the treatment and pain followed consecutively. Clinically we could confirm the facial swelling with its tenderness, spontaneous pain, and severe trismus (Fig. 1A). On radiological finding, low density radiopaque lesion with contrast extravasation in left masticator space and peripheral contrast enhancing low density lesion

at right masticator space was noted especially lateral to both coronoid notch (Fig. 1B). The white blood cell count, neutrophil count, C-reactive proteins were within normal limits, leading to rule out infection. However, concerning suspected hematoma formation and possible secondary infection, incision and drainage with silastic tube insertion on left masticatory space was done on the day of visit. Despite few weeks of observation with dressing, the patient showed little pain relief and no significant progression in facial swelling and tenderness. Two days after the first visit, excessive bleeding occurred on irrigation through silastic drain and palpable pulsation was confirmed. Suspecting vascular pathology, pressure hemostasis on pulsating lesion was done immediately and on the same day angiography on left carotid artery was performed. The angiography

revealed a large vascular sac on the medial portion of IMA of the left side; the lesion was diagnosed traumatic pseudo-aneurysm (Fig. 2A, B). On the same day, the patient was referred to Department of Neurosurgery, and embolization was performed under simultaneous angiography. Under the guidance of 5.5F femoral sheath (Radifocus Introducer II, Terumo, Tokyo, Japan) and 5F guiding catheter (IR Co Ltd., Tokyo, Japan) to left external carotid artery, the IMA was embolized with multiple coils and histoacryl glue (Fig. 2C). After the embolization, no post-operative hemorrhage occurred, and within 2 weeks of progress observation, the left facial swelling and related symptoms disappeared (Fig. 3)

The study protocol and access to patient records were approved by the Institutional Review Board of Wonju Severance Christial Hospital (CR319303), Wonju, Korea.

Fig. 1. Clinical and radiographic findings. (A) The patient on the first visit after the masseteric nerve block at local clinic. Facial swelling with its tenderness, spontaneous pain, and severe trismus has been observed. (B) About 32×30×40 mm sized low density radio opaque lesion at left masticatory space with contrast extravasation. Peripheral contrast enhancing low density lesion at right (arrows).

Fig. 3. Two weeks after embolization procedure. The left facial swelling and relating symptoms were disappeared.

Fig. 2. Internal maxillary artery (IMA) of the left side. (A) Left IMA angiography, embolization. (B) The angiography revealing a large vascular sac on the medial portion of left IMA, presumably traumatic pseudo aneurysm. (C) Under the guidance of 5.5F femoral sheath and 5F guiding catheter to left external carotid artery, the IMA was embolized with multiple coils and histoacryl glue.

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

DISCUSSION

According to the patient's past history and referral to the local clinician, the etiology of the pseudo-aneurysm on this case was suspected as iatrogenic trauma caused by radiofrequency device (Thermocon; Sometech, Seoul, Korea) while performing masseteric nerve block. There have been reports of pseudo-aneurysms after RFA in number of large arteries [4,5]; however, pseudo-aneurysm in IMA due to RFA has never been reported.

RFA is well known as minimally invasive surgical method applied to selective indications of hepatic, pulmonary, vertebral tumor and also can be utilized in chronic pain disorders by thermo-coagulating ganglions and peripheral nerve, resulting in nerve block. Hematologists use RF as an alternative method of endovenous obliteration of saphenous vein reflux and it is also applied to the surgical therapy of sleep apnea in fields of otolaryngology and oral surgery [6-9].

RFA involves percutaneous insertion of an electrode into a lesion under thorough guidance of radiologic, ultrasonic devices. Then a high frequency, alternating current (350-500 kHz) is delivered through the lesion causing agitation of the tissue ionic molecules, which in turn produces frictional heat. This energy heats the tissue temperature up to 100°C. Unlike electrocautery or CO₂ laser, which directly delivers high energy to destroy targeting tissues, the heat generated from RFA device is created by the tissues' resistance to radiofrequency current. Such mechanism of RFA emits relatively uniform zone of radiant and conductive heat which is about 5-10 mm radius from the electrode [10].

Radiofrequency energy emitted through the electrode generates heat leading to coagulative necrosis. Necrotic tissues are then metabolized resulting in tissue contraction or obliteration. Percutaneous RFA has been used as a less invasive alternative to surgical resection of primary of metastatic lesions who have failed or are not candidates for surgery.

RFA, as mentioned above, is a useful therapy which can be applied in many fields, however, its usage may often

lead to serious complications including pseudo-aneurysms. Improper location of electrode around trigeminal nerve branches may result in paresthesia of skin segments, facial muscle weaknesses, diplopia, and anesthesia dolorosa [11]. Tamai et al. [12] reported the intrahepatic pseudo-aneurysm after RFA therapy of hepatocellular carcinoma. Michael et al. [5] reported pseudo-aneurysm of lingual artery after tongue base reduction using RFA due to patient's sleep apnea. Schmerber et al. [13] reported the case of internal carotid artery false aneurysm due to gasserian ganglion thermo-coagulation under the diagnosis of trigeminal neuralgia. Many reports on complications due to radiofrequency ablation especially that of pseudo-aneurysm formation made authors to presume that electrode insertion, or heat energy of RFA may harm surrounding structures of targeted operation site.

Sakurai et al. [14] reported the case of pulmonary artery pseudoaneurysm after RFA of pulmonary epitheloid hemangioendothelioma and suggested its etiology as the penetration trauma and vessel wall damage by the heat energy. Performers of RFA suggest that the likelihood of potential thermal injury induced by RFA is low because of blood flow. However, we speculated that the friable arterial wall cannot always withstand the thermal energy depending on the proximity of the artery.

In our case, it is presumable that local clinician focused only on detecting the masseteric nerve without thorough consideration about surrounding structures. Considering the contrast computed tomography of the patient, the targeted site of the RFA is the coronoid notch area which is adjacent to the IMA. The left IMA of the patient may have been damaged by improper location of the electrode, vessel wall damage due to RFA energy, or both.

RFA must be performed with thorough knowledge of anatomic structures adjacent to the targeted site and real-time monitoring of the operation with C-arm or ultrasonography is highly recommended in order to prevent complications. It must also be done by a skilled operator who has sufficient understanding of the targeted anatomy. Moreover, the patient must be warned about possible damages of anatomic structures nearby and consequent complications including pseudo-aneurysm.

Several therapeutic options are introduced for the

treatment of IMA pseudo-aneurysm, such as external carotid artery ligation and IMA ligation under surgery [3,15]. However, of many treatment options, selective embolization with angiography is less invasive and more sophisticated than traditional surgical procedures. It is possible to gain control of the damaged vessel in places difficult to reach surgically, and it reduces the risk of bleeding and revascularization of the pseudo-aneurysm by collateral circulation [16].

In conclusion, we report previously unreported case of pseudo-aneurysm of IMA iatrogenically caused by RFA. The patient described in this report presented excessive facial swelling immediately after RFA therapy. Under proper diagnosis with angiography the patient's left IMA was successfully embolized. Pseudo-aneurysm may cause life-threatening event followed by massive bleeding. Therefore, when performing RFA, thorough understanding of anatomic structures adjacent to the targeting lesion is required. And the therapy must be performed by experienced specialist under radiologic or ultrasonic guidance particularly when complications are expected.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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