Journal of Clinical Neuroscience xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

Clinical Study

Traumatic pseudoaneurysms of the superficial temporal artery: Case series, anatomy, and multidisciplinary treatment considerations

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ARTICLE INFO

Article history:
Received 30 January 2014
Accepted 8 February 2014
Available online xxxx

Keywords:
Blunt head injury
Embolization
Neurosurgery
Pseudoaneurysm
Superficial temporal artery

ABSTRACT

Pseudoaneurysms of the superficial temporal artery (STA) are rare vascular lesions of the external carotid artery system and are most often incurred after blunt head trauma. Diagnosis can be made on clinical grounds, and is confirmed by ultrasonography (US) or CT angiography. Surgical ligation and excision of the aneurysm remains a definitive treatment modality. Patients with STA pseudoaneurysms are often referred to a neurovascular specialist given the neurovascular origin and gross anatomic location of these lesions. Three patients presented to our neurovascular service several weeks following blunt head injury to the anterolateral skull surface with progressive, palpable, pulsatile masses. Each patient underwent CT angiography, which demonstrated a pseudoaneurysm of the frontal branch of the STA, followed by operative ligation and *en bloc* excision. The present series highlights the anatomical considerations relevant to STA injury and pseudoaneurysm formation following blunt head trauma and reviews the necessary diagnostic and treatment considerations.

1. Introduction

Pseudoaneurysms of the superficial temporal artery (STA) are rare vascular lesions of the external carotid artery system. Since their original description in the mid 1600s, approximately 400 cases have been reported, most as a result of blunt head injury [1]. The lesions typically present as painless, pulsatile masses at the site of the injured arterial branch and are often associated with a palpable thrill [2]. Pseudoaneurysm rupture is the cardinal cause of morbidity associated with these STA lesions. Diagnosis is made by duplex ultrasonography (US) [3] or CT angiography [4,5]. Surgical ligation and excision of the pseudoaneurysm is considered the standard therapy, though coil embolization [6] and US-guided thrombin injection [7] have recently emerged as alternate minimally invasive treatment options [2]. Given the neurovascular origin and gross anatomic location of these lesions, patients with STA pseudoaneurysms are often referred to neurovascular specialists for treatment.

The frontal branch of the STA is particularly vulnerable to injury following blunt or penetrating head trauma given its anatomic course along the anterolateral skull surface. In this report, we describe three patients with blunt head trauma who subsequently developed pseudoaneursyms of the frontal branch of the STA at the superior temporal line, review the relevant anatomical considerations that contribute to STA injury, and comment on our approach to definitive treatment.

2. Case illustrations

2.1. Patient 1

A 20-year-old man presented to our outpatient cerebrovascular clinic 4 weeks after being struck in the left frontal region with a hockey puck. Over the next 2 weeks, he developed a small pulsatile mass near the left forehead. CT angiography demonstrated an 8 mm pseudoaneurysm of the frontal branch of the STA (Fig. 1A). The patient was taken to surgery for definitive treatment. In brief, a small incision was made over the palpable mass. Tenotomy scissors were used to circumferentially dissect around the lesion. Once the pseudoaneurysm was entirely mobile (Fig. 1B), the afferent and efferent arteries were coagulated with bipolar cautery and incised to remove the lesion *en bloc* (Fig. 1C). Pathology demonstrated a muscular artery with disruption of the wall without evidence for

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http://dx.doi.org/10.1016/j.jocn.2014.02.004
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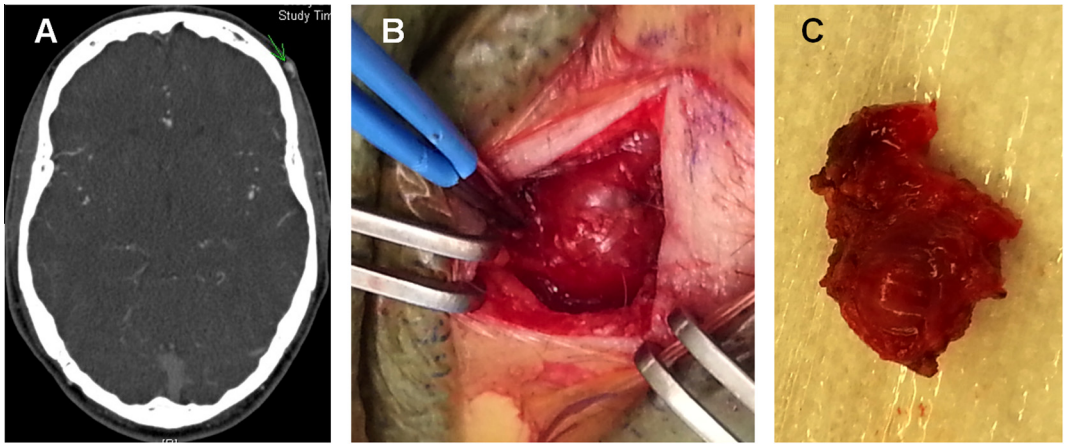

Fig. 1. Patient 1. Axial CT angiogram of the 8 mm pseudoaneurysm of the frontal branch of the left superficial temporal artery (arrow) (A). Intraoperative photograph of the pseudoaneurysm prior to ligation of the afferent and efferent arteries (B). Intraoperative photograph of the resected pseudoaneurysm (C). (This figure is available in colour at www.sciencedirect.com)

vasculitis. The patient was discharged from the hospital on the first postoperative day.

2.2. Patient 2

A 16-year-old man presented to our outpatient cerebrovascular clinic several weeks after being struck in the right frontal region with a baseball, with a small, pulsatile mass near the right forehead. CT angiography revealed a 7 mm pseudoaneurysm of the frontal branch of the left STA (Fig. 2). The patient was taken to surgery, and the lesion was excised. The patient was discharged from the hospital on the first postoperative day.

2.3. Patient 3

A 33-year-old man presented to our institution's emergency department 3 weeks after a head-on collision with another player during a rugby match. He gradually developed an 11 mm palpable mass in the left frontal region, and CT angiography confirmed a pseudoaneurysm of the frontal branch of the STA (Fig. 3). He was taken to surgery, and the lesion was excised. The patient was discharged from the hospital on the first postoperative day.

3. Discussion

STA pseudoaneurysms are rare vascular lesions that classically occur after blunt head injury due the shearing force the vessel experiences during such traumatic interactions [2]. However, STA pseudoaneurysm formation has also been described following penetrating head trauma [8,9] and various neurosurgical procedures, including external ventricular drain placement [10], Gardner–Wells tongs application [11], and craniotomy for intracranial aneurysm clipping [12]. Their clinical course is often benign, though in rare instances patients may present with a large subgaleal hematoma and anemia from pseudoaneurysm rupture. US and CT angiography are effective diagnostic modalities. Surgical ligation and excision is a definitive form of treatment with US-guided thrombin injection and endovascular coil embolization as alternative minimally invasive treatment options [2]. Our neurosurgical series highlights the classic historical, diagnostic, and treatment details of STA pseudoaneurysms and reinforces the important anatomical considerations related to their formation following head injury.

3.1. Anatomy

The frontal branch of the STA is particularly susceptible to blunt head injury given its gross anatomic location. The STA is a terminal branch of the external carotid artery. After crossing over the root of the zygoma, the STA enters the scalp just deep to the galea aponeurotica and superficial to the temporalis muscle. Within this fascial layer, the STA bifurcates into a frontal and parietal branch. The frontal branch courses anteriorly over the temporalis muscle and crosses the superior temporal line as it runs toward the orbicularis oculi muscle. Here, the frontal branch anastomoses with the

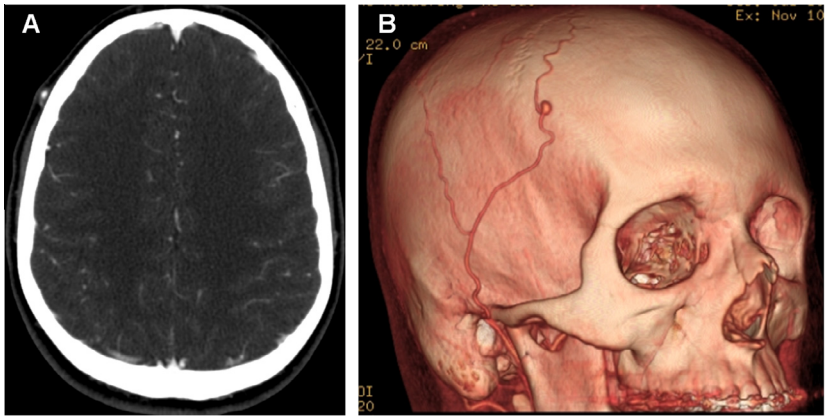

Fig. 2. Patient 2. Axial CT angiogram (A) and three-dimensional CT angiogram (B) of the 7 mm pseudoaneurysm of the frontal branch of the right superficial temporal artery. (This figure is available in colour at www.sciencedirect.com)

Please cite this article in press as: Stapleton CJ et al. Traumatic pseudoaneurysms of the superficial temporal artery: Case series, anatomy, and multidisciplinary treatment considerations. J Clin Neurosci (2014), http://dx.doi.org/10.1016/j.jocn.2014.02.004