



Case report

A rare case of large left internal maxillary artery pseudoaneurysm secondary to mandibular fracture: A case report and review of the literature

Vicente J. Cogollo^a, Adel Elkbuli^{a,*}, Mark McKenney^{a,b}, Michael Renda^{a,b}

^a Department of Surgery, Division of Trauma and Surgical Critical Care, Kendall Regional Medical Center, Miami, FL, USA

^b University of South Florida, Tampa, FL, USA

ARTICLE INFO

Keywords:

Pseudoaneurysm
Ground level fall
Oral and maxillofacial surgery
Coil embolization
Trauma outcomes

ABSTRACT

Introduction and importance: Pseudoaneurysms secondary to traumatic vessel wall disruption are a rare but potentially fatal complication after traumatic injury. The majority of the cases are found incidentally.

Case presentation: An 80-year-old woman was brought into our Level 1 Trauma Center after sustaining a ground-level fall with significant facial swelling. Her imaging revealed an acute traumatic comminuted fracture of the right mandibular condyle and left mandibular ramus. The patient underwent closed maxillomandibular fixation (MMF) to stabilize fractures, and allow the swelling to decrease for definitive fixation. During the definitive procedure, profuse bleeding was encountered. CT angiography evaluation was immediately performed and determined the presence of a left internal maxillary artery pseudoaneurysm which was successfully treated by coil and glue embolization.

Clinical discussion: This case highlights an unusual presentation of a vascular injury following major traumatic mandibular fracture and its management. Mandibular fractures have been reported in a series of cases to be a risk factor for vascular injuries. When a vascular injury is suspected, or the evaluation is unclear, surgeons should carefully determine the necessity to perform additional studies like CT angiogram. Vascular injuries secondary to mandibular fractures can be fatal if left unrecognized and untreated. Hence adequate recognition and treatment are warranted to avoid prolonged length of stay with bad outcomes.

Conclusion: Optimal management of pseudoaneurysms is achieved by endovascular approach with prior resuscitation and adequate hemodynamic stabilization. Open surgical management is deferred only for those cases where endovascular treatment is not available, or disruption is found intraoperatively.

1. Background

Mandibular fractures account for one of the more frequent emergency department (ED) visits secondary to facial trauma. This fracture frequently happens in the geriatric age group [1,2]. These types of fractures impose significant morbidity due to the impact of the patient's ability to eat. Mandibular fractures are classified based on location: angle, body, ramus, and symphysis. The angle is the most common fracture site followed by the body and symphysis [3].

Current management is usually operative in which open reduction and internal fixation (ORIF) is the most commonly performed [2]. Due to anatomical characteristics, facial bone fractures are sometimes associated with neurovascular injuries. Thus, it is important to consider the

location of the fracture and associated structures that can be damaged.

Pseudoaneurysm or false aneurysm is defined as the traumatic partial disruption of the arterial wall, resulting in extra-luminal blood contained by the adventitia layer or nearby tissues [4]. Pseudoaneurysms are a rare but potentially fatal complication that needs a high index of suspicion combined with adequate radiology studies for diagnosis.

We present a case of left internal maxillary artery pseudoaneurysm formation after a traumatic fall. This report aims to call attention to this type of injury, which can be associated with facial fractures. Timely diagnosis and treatment have shown to decrease morbidity, mortality, and even cost to the health care system [5]. This work has been reported in line with the SCARE 2020 guidelines [6].

Abbreviations: OMFS, Oral and maxillofacial surgery; IMC, Intermediate care unit; ICU, Intensive care unit; CT, Computed tomography; CTA, Computed Tomography Angiography; IR, Interventional radiology; MMF, maxillomandibular fixation; ORIF, open reduction and internal fixation.

* Corresponding author at: Department of Surgery, Kendall Regional Medical Center, 11750 SW 40th St, Miami, FL 33175, USA.

E-mail address: Adel.Elkbuli@hcahealthcare.com (A. Elkbuli).

<https://doi.org/10.1016/j.ijscr.2021.106072>

Received 11 May 2021; Received in revised form 30 May 2021; Accepted 2 June 2021

Available online 9 June 2021

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2. Case report

The patient is an 80-year-old woman who was admitted to our Level 1 Trauma Center after sustaining a ground-level fall with facial trauma at her assisted living facility. An initial physical examination revealed significant left facial ecchymosis and swelling, no lacerations or skin breakdown was noted. Her past medical history revealed Alzheimer's dementia, hypertension, and functionally dependent health status (secondary to dementia). Computed Tomography (CT) without contrast showed acute traumatic, comminuted fractures of the right mandibular condyle and left mandibular ramus with subluxation of the left mandibular condyle and marked surrounding hematoma/soft tissue swelling (Fig. 1a, b).

The oral and maxillofacial surgery (OMFS) team was consulted. Due to the patient's significant facial swelling, it was decided to perform two separate procedures to improved outcomes and decrease the risk of complications. Initial management was a closed maxillomandibular fixation (MMF) (Fig. 1c, d, e). The procedure went uneventful.

The swelling resolved over the next week and she was brought back to the operating theater for her 2nd stage intervention. During the procedure the patient was found to have profuse bright bleeding during dissection, quickly surmised to be from the left internal maxillary artery. This was difficult to control but after several attempts the bleeding was controlled with packing leading to tamponade. Interventional radiology

was consulted intraoperatively, and a stat CT Angiography (CTA) of the head and neck was obtained, revealing a large left internal maxillary artery pseudoaneurysm with active extravasation (Fig. 2a, b). This was followed by an emergent neck angiography by the interventional radiology team. The pseudoaneurysm was identified (Fig. 3a, b) and treated with coil and ethylene vinyl alcohol copolymer ("glue") embolization (Fig. 3c–f). The patient tolerated the procedure well without complications. Her hemoglobin levels were stable after the intervention. She presented a satisfactory evolution in the following days. She was discharged in stable condition.

3. Discussion

Facial injuries are a common burden in the trauma setting, especially in the elderly population. Facial trauma of individuals coming from nursing homes is also common, secondary to trip and falls, as reported by Bobian et al. [1]. This case report emphasizes the importance of early and timely diagnosis and management of facial trauma with associated vascular injuries, and its impact on patient outcomes. The case described showed how a patient had intraoperative bleeding during the hospital stay that could potentially have been avoided with a different approach during admission.

Mandible fractures comprise approximately 25% of all facial fractures. These fractures are divided based on location. Multifocal fractures

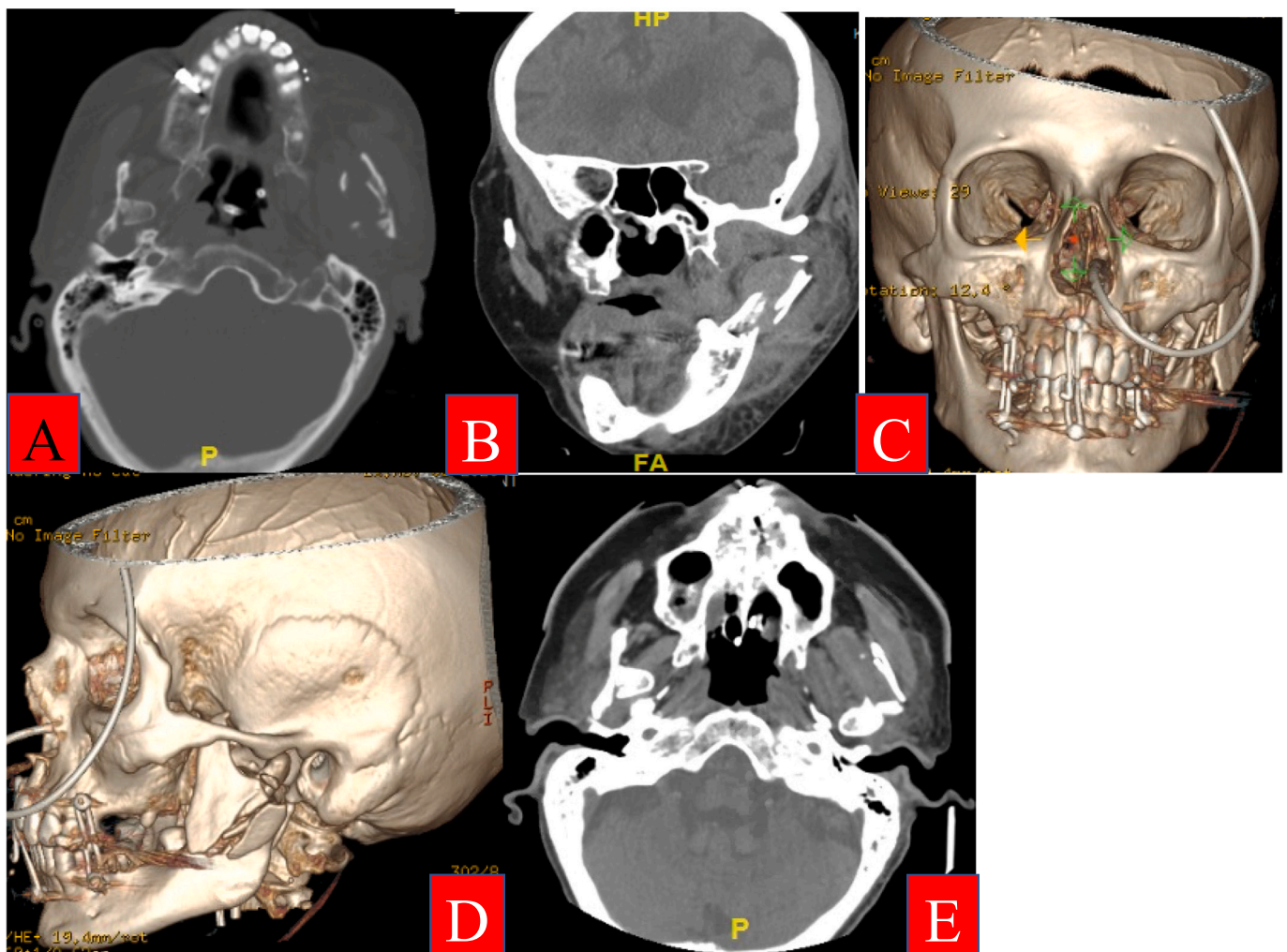


Fig. 1. Admission Head CT and 1st follow up Facial CT with 3D reconstruction after maxillomandibular fixation. (A) Axial CT shows bilateral displaced mandible fractures. (B) Marked soft tissue swelling of left maxillary and mandibular regions (C, D) 3D reconstruction shows fixation of mandible after initial surgical intervention. (E) Significant swelling decrease after course of steroids.

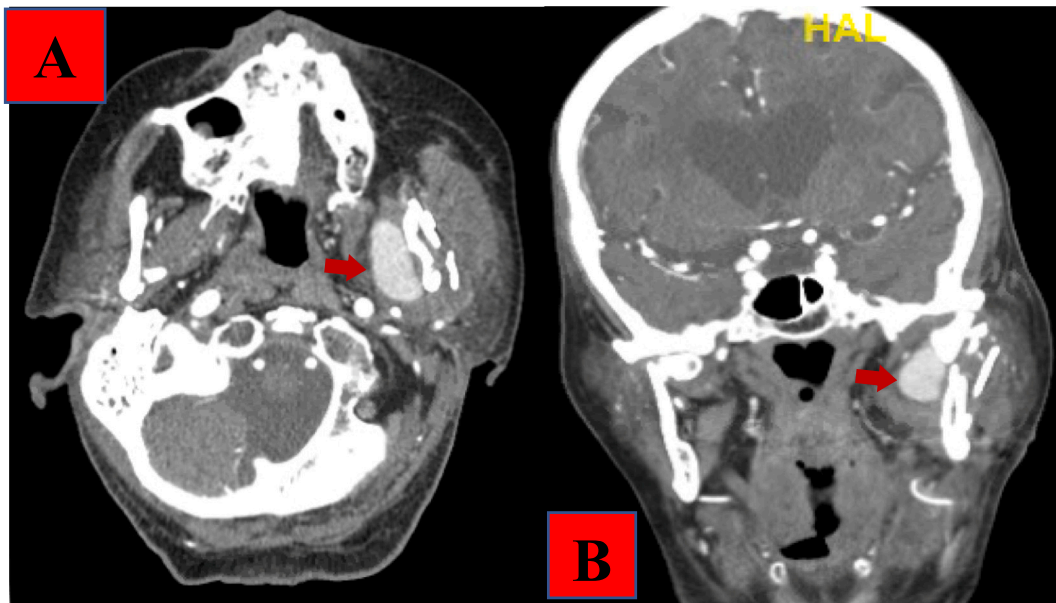


Fig. 2. Head and Neck CTA after 2nd operative intervention. (A) Axial image demonstrates a pseudoaneurysm medial to left mandibular fracture. (B) Coronal image shows the pseudoaneurysm off of the left internal maxillary artery.



Fig. 3. Head and Neck angiography with coil embolization of left internal maxillary artery. A, B) Localized collection of contrast confirms left internal maxillary artery pseudoaneurysm noted on CTA. See red arrows (C, D) Coil embolization procedure. See red arrow and circle. (E, F) Post coil embolization angiogram shows complete obliteration of pseudoaneurysm. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

usually often with condylar/supracondylar as the most common location [7]. This should have special attention because the internal maxillary artery runs through the condylar/supracondylar region. Consideration should be given to potential arterial injury with these fractures. Surgeons generally recommend that facial fractures should be repaired early to decrease morbidity and mortality. Although the supporting data on this is thin and the literature defines “early” differently, sometimes within 2 days and other times within a week [8–10].

A treatment protocol for mandibular fractures published by Chu et al. showed variability among time and method of fixation [11]. This is mainly because type of injury and patient characteristics play a big role in the decision-making process [11]. Once a pseudoaneurysm is suspected, careful differentiation should be established between a true aneurysm in which all three components of the arterial wall are intact versus a pseudoaneurysm where the hematoma is contained by fibrin products and/or surrounding structures [12]. The management of true aneurysm and pseudoaneurysm usually differs and requires timely diagnosis and prompt intervention in order to achieve good prognosis and outcomes. Potential rupture and hemorrhage should be the main concern, close monitoring and early intervention is a key to avoid poor prognosis and fatal complications. If a rupture is present, immediate and adequate resuscitation with blood should be promptly initiated to avoid hemorrhagic shock.

Pseudoaneurysm formation after traumatic injuries can take weeks to develop after the initial insult [13]. Moreover, it is imperative to perform a proper history and physical examination during primary and secondary evaluation. Pseudoaneurysm diagnosis is usually done with a combination of scans including but not limited to computerized tomography with and without contrast, computerized tomography with angiography, and ultimately angiography [13]. In the majority of cases mandibular fractures are fixed without complications. Nevertheless, in the last 2 decades with the improvement of radiological imaging, more cases of vascular injuries are being reported with different treatment modalities and outcomes. Likely, due to the lack of a current and updated treatment guidelines this is ultimately placing this complication on the scope of providers encountering facial fractures.

In our case report the recognition of the vascular complication was done during fixation, not an optimal time for diagnosis but our response and management was optimal achieving good results minimizing mortality.

Internal maxillary artery pseudoaneurysm is difficult to manage surgically due to its location. Surgical ligation could be attempted but is challenging and is commonly reserved in cases where tamponade is ineffective or endovascular treatment is not available [14]. Even so, in those cases like our report where the bleeding was encountered intraoperatively during fixation, the endovascular or interventional should be immediately and readily available to intervene and control the bleeding intraoperatively. Prophylactic consultation and involvement of the endovascular and/or interventional radiology team is recommended in cases of complex and severe mandibular fractures, particularly those with proximity to a vascular structure that could be potentially injured due to excessive dissection/manipulation. Over the last decade, minimally invasive procedures, including ultrasound guided compression and thrombin injection, coil and glue embolization, and endovascular repairs of vascular injuries have been augmenting or even replacing open procedures due to its improved outcomes and prognoses [15–17].

The role of angiography has changed over the past decade. The availability of CTA imaging shifted the indication of catheter angiography to less invasive studies with less risk of complications. The modified Denver criteria is a commonly cited and useful guide to determine indications of craniocervical CTA after trauma. Risk factors for vascular injury includes: cervical spine fracture, mid face LeFort II and III fractures, severe traumatic brain injury with GCS <6 and skull base fractures with involvement of carotid canal. Noted that isolated mandibular fractures are not part of the indication leaving the gap whether CTA should be considered [18,19]. In addition, the Denver

criteria injuries are defined as being secondary to high energy mechanisms and a fall from standing does not usually meet these criteria.

Ultimately, facial fractures that compromised the condylar/supracondylar region arise the question if we should obtain a CTA during admission regardless of the mechanism of trauma? This is a point of discussion of this case report, which after literature reviewed would be an acceptable indication. Last but not least, the potential contrast-induced nephropathy also arises the question of whether this would be optimal in the elderly population.

4. Conclusion

Optimal management of ruptured pseudoaneurysm is achieved by prompt endovascular treatment with adequate resuscitation and stabilization. As mentioned before open surgical management is deferred only for those cases where endovascular treatment is not available, or disruption is found intraoperatively. This case presented a patient where diagnosis was made intraoperatively and later confirmed with angiography. The satisfactory outcome can be attributed to the timely intervention utilizing IR-guided endovascular approach. However, poor prognosis and fatal complications maybe limited if clinicians are able to make early diagnosis on admission. Consequently, clinicians should have a low threshold for suspicion of this worrisome complication that is frequently unrecognized. Prompt diagnosis, which requires a high index of suspicion, decreases morbidity and mortality, especially in the elder population. Nevertheless, all patients present unique injuries that need to be addressed accordingly.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical approval

This report was conducted in compliance with ethical standards. Informed written consent has been obtained and all identifying information is omitted.

Informed consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Registration of research studies

N/A. This is a case report study.

Guarantor

Michael Renda. Mark Mckenney.

Provenance and peer review

Not commissioned, externally peer-reviewed.

CRedit authorship contribution statement

VC, AE, MM, MR– Conception of study, acquisition of data, analysis and interpretation of data, drafting the article, and revision of article.

MR – Management of case, revision of article, and final approval of the version to be submitted

VC, AE, MM, MR – Approval of the final version for submission.

Declaration of competing interest

No conflicts of interest.

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