Traumatic pseudoaneurysm of the facial artery: late complication and effects on local blood flow

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Objective. Pseudoaneurysms are vascular injuries resulting from a rupture of the vessel walls with blood extravasation into perivascular tissues. Proper treatment is required to prevent rupture and intense bleeding. This article reports a case of pseudoaneurysm of the facial artery that evolved to a late complication, presenting dehiscence of suture and exposure of the wound and bleeding after the initial injury and also discusses the effects of vascular response from the involved vessels by comparing them against the contralateral side.

Case report. A healthy 17-year-old male was admitted with an injury of approximately 35 mm in length in the right cheek with an exposed clot inside the injury and local bleeding after a stabbing 11 days before. CT angiography showed rupture of the facial artery and formation of a pseudoaneurysm with an organized clot. The patient was treated by means of surgery under local anesthesia and intravenous sedation. The facial artery was located and attached by suture. The wound was explored and clots were removed. The patient was discharged on the first postoperative day and he had an excellent scarring standard with no unfavorable event.

Conclusions. The authors conclude that this surgical technique is an effective method for treating such injuries, as it is easily performed and can be conducted by the oral and maxillofacial surgeon assistant.

Vascular complications of superficial branches of the external carotid artery (ECA) are extremely rare1,2 and can have a potential for major complications.2 Diagnosis and proper treatment are mandatory, given the potential for expansion and rupture3-5; however, they were not yet well defined.

Pseudoaneurysm (PA) results from a rupture of the vessel walls with blood extravasation into perivascular tissues. Because of an increase in the pressure caused by blood extravasation, the resistance of adjacent tissues nullifies the pressure by the blood flow from the injured vessel, thus keeping bleeding under control and making an organized clot.2 The established clot liquefies over time and communication between the artery and the aneurysmal sac normally occurs, which clinically manifests as a pulsating mass.2,8 For that reason, the PAs usually occur as a late event ranging from days, months, or even years after the trauma.3 If the systolic pressure exceeds the resistance of the neighboring tissues, rupture and intense bleeding may occur.3

Most of the time, a traumatic event is the main etiology of PAs in the superficial branches of the ECA, and they especially affect the superficial temporal artery.10 Penetrating wounds, such as those caused by gunshots and stabs, as well as closed facial injuries, are most frequently related to such lesions. These can also occur as complications of surgical procedures, such as dental extractions and orthognathic surgery.4,5 In such situations, the traumatic event may be related to the surgical procedure itself4 or as a result of some postoperative incident.5,11 Of the 386 cases of traumatic facial and temporal aneurysms dated 1644 through 1998 reviewed by Conner et al.,12 only 7% were located in the facial artery.

Complications arising from the lack of adequate diagnosis and treatment of facial artery PAs are estimated, but are poorly documented and reported in the literature. This article reports a case of PA of the facial artery that evolved to a late complication, presenting dehiscence of suture and exposure of the wound and bleeding 11 days after the initial injury, which was
treated with a ligature of the facial artery and ensuing debridement and reconstruction of the wound. It also discusses the effects of vascular response from the involved vessels by comparing them against the contralateral side.

CASE REPORT
A healthy 17-year-old male was admitted with an injury of approximately 35 mm in length in the right cheek with an exposed clot inside the injury and local bleeding. He reported to have been stabbed 11 days before in a fight at school. He was admitted to an emergency center, where he was treated with suture of the wound and discharged 4 days later. Over the ensuing 4 days at home, the patient reported minor but constant bleeding. On the fourth day, there occurred dehiscence of the suture, opening of the wound with clot exposure, and an increase in local bleeding. He was again admitted to the same emergency center. The patient remained hospitalized for another 3 days under clinical treatment for which medication was administered and a compressing bandage was applied. Only then was he forwarded to our department.

Upon admission, blood tests showed hemoglobin at 9.0 g/100 mL and hematocrit at 27.6%. Computed tomography (CT) angiography showed rupture of the facial artery and formation of a PA with an organized clot (Fig. 1). Constriction of the right-side artery was observed with blockage of the rising blood flow, and an increase in the blood flow of the upper labial artery and transverse facial artery of the face on the same side. Because of the increase in blood flow in the transverse artery of the face, the blood flow in the angular artery was preserved—the latter being a terminal branch of the facial artery and is naturally fed by that artery. Such findings could be observed and compared against the nonaffected side (Fig. 2).

The patient was treated by means of surgery under local anesthesia and intravenous sedation. A small 10-mm incision was made below the edge of the mandible following pulse palpation of the facial artery (Fig. 3). The facial artery was located and attached by suture. The wound was then explored and clots were removed. The wound was cleaned and sutured; no abnormal bleeding was found (Fig. 3). The patient was discharged on the first postoperative day. On the seventh postoperative day, he had an excellent scarring standard with no unfavorable event. That condition was maintained after 3 months of treatment (Fig. 4). The patient was first briefed on the study objectives and then signed a term of consent.

DISCUSSION
The human face is known for its abundant blood supply and potential bleeding when traumatized. Nevertheless, most bleeding events result from the whole of injuries in several minor vessels, and some bleeding from larger branches of the ECA can be poorly diagnosed. The soft tissues and face bones protect the main vessels in the face, but specifically in some regions when they surface and cross bone structures, the vessels become more vulnerable and susceptible to injuries.

Diagnosis includes clinical and image examinations. A differential diagnosis should include PA, true aneurysm, and arteriovenous fistula (AF). PA differs from AF in various standards. An AF shows a continuing sensation of vibration and noise, which is intensified during systole, with murmur transmission, whereas in PA the noise is perceptible only during systole. Another standard of difference is that the PA tends to compress the neighboring vessels through the aneurysmal sac, whereas the fistula does not. True aneurysm is characterized by dilatation of the vessel wall with preservation of the innermost layer of the 3 (intima, media, and interna) that make up the vessel wall. No communication exists between the blood and the neighboring tissues. In PA, the intima layer is at least partially injured and perivascular tissues limit the blood, thus forming the wall of the aneurysmal sac. Establishing the difference between them may be clinically impossible, because in some situations the literature uses these 2 terms interchangeable.

CT angiography has currently replaced digital subtraction angiography as a chosen method for initial assessment of injuries of the cervical vessels. CT angiography enables accurate evaluation of patients as well as adequate planning, whether by surgery or by interventional radiology. It also enables an assessment of the main vessels in the cervicofacial region and its branches and allows for evaluating the size of the PA, and it can be obtained in 10 minutes. This imaging examination is very effective in defining the extent and involvement of vascular injury, as long as it is properly analyzed. Ultrasound examination was contraindicated in the present case because the risk of clot displacement during the examination was imminent.

Some authors support the use of interventional radiology techniques for vessel embolization as a chosen method for treating PA of the face. The great advantage of embolization is the occlusion of the proximal and distal vessels to the injury, thus providing better blood flow owing to the large number anastomoses of the face; moreover, it can be conducted with local anesthesia.

Nevertheless, the incidence of embolization-related complications is much greater than those related to surgical treatment and include necrosis, infection, and detachment of the embolus into the blood flow. There is still little information on the embolization of ECA branches when compared with the inner carotid artery owing to the good rate of success with surgical treatment, which is the chosen method for injuries of the facial artery, despite embolization of facial artery having been done successfully in similar situation before. In that case report, surgery was performed easily and effectively.
Easy artery location and ligation is a routine procedure in skin approaches for treating mandible fractures and is easily performed by the oral and maxillofacial surgeon. Identification of the facial artery when crossing the lower mandible edge is detected without effort by simple digital palpation and its ligation does not compromise the vascularization of the face. For these reasons, ligation of the facial artery is the chosen mode for treatment of PA because of its easy execution and low rate of complications and it can be conducted by the assistant oral and maxillofacial surgeon.

The effectiveness of facial artery ligation in the present case was proved right after handling the wound, when the clot that was plugging the PA was removed and did not cause any significant bleeding, with hemostasis being easily achieved. Surgical exposition of the carotid artery under general anesthesia does not seem necessary for the treatment of PA with exclusive involvement of the facial artery; it was considered too traumatic to be performed when local access to the facial artery had failed to control bleeding.

Suture dehiscence and wound exposure can be easily explained by the mechanisms involved in the pathogenesis of FA. In its formation, the neighboring tissues are responsible for acting against the pressure from blood
extravasation, which leads to an increase in wound stress. The effect of the pressure by the extravasated blood, increasing the stress on the edges of the wound, causes ischemia and consequent necrosis in sutured tissues. In addition, a reduction in the flow of blood adjacent to the PA occurs by means of compression of the neighboring blood vessels, thus contributing to a bad perfusion of the wound, which in its repair process has an increased metabolic demand. However, that increased demand is not supplied in that pathological condition. In this way, on the eighth day after trauma, the wound was reopened and the clot was exposed. Despite such exposure and a delay in treatment, the bandages helped maintain the clot and prevent it from being displaced. Such situation prevented life-threatening bleeding from occurring, although the bleeding was slight and continuous.

Vascular contraction is a natural response from the muscle fibers contained in the walls of the arterial vessels, as can be observed in Fig. 2. Comparison of the blood flow on each side allows for an interesting observation of the vascular response of the face. On the
right side, where the lesion occurred, there was contraction and narrowing of the facial artery, which caused an important increase in the blood flow in the upper labial artery and transverse facial artery. On the unaffected side, the upper labial artery and transverse facial artery are practically invisible to CT angiography, which maintains a better-distributed blood flow. Owing to the injury to the facial artery, its rising blood flow was obstructed and diverted medially toward the upper labial artery, whereas the angular artery practically kept its volume arising from the support provided by the transverse facial artery (Fig. 2). These observa-

Fig. 3. Intraoperative view. A, Small incision below the lower edge of the mandible with identification of facial artery and subsequent ligature. B, Postoperative aspect immediately after ligature of the facial artery and removal of the clots and suture of the wound.

Fig. 4. Three-month postoperative aspect. A and B, Front and side view of the patient with good wound healing or repair and small residual scar.
tions strengthen the information regarding the role of the anastomoses existing in the facial region.

Vascular injuries must be present in the assessment of facial traumas, especially in the list of late complications. Major complications can be a result of lack of correct diagnosis and treatment. In the present case, when the patient was admitted, he had hypovolemic anemia (hemoglobin: 9.0 g/100 mL and hematocrit: 27.6%), which could have resulted in intense bleeding if detachment of the clot had occurred and life-threatening hemorrhage could have been triggered. After correct handling, a fast recovery was possible with no major sequels being observed. This case report is particularly interesting because it associates a series of important events, as the flaws observed in the initial treatment, an unusual complication of suture dehiscence and exposure to PA occurred, a simple and effective treatment method was performed, and in addition the case exemplified vascular responses after injury of the facial artery.

CONCLUSIONS
The authors presented a facial artery PA case that evolved from suture dehiscence and wound exposure. The patient was treated with surgery through ligature of the facial artery and ensuing exploration of the wound. The authors conclude that such surgical technique is an effective method for treating these types of injury, because it is easily performed and can be conducted by the assistant oral and maxillofacial surgeon. Special care should be taken concerning any increase in pulsating volume after facial trauma, and CT angiography plays a major role in the diagnosis of this injury. Definitely, PA must be considered as a late complication in facial traumas.

REFERENCES

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