Case report

A Case of a Divided Maxillary Artery in the Infratemporal Fossa

By

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Summary: A divided maxillary artery was found in the left infratemporal fossa of a 63-year-old male cadaver during a student dissection practice. The maxillary artery, which arose from the external carotid artery at the posterior border of the ramus of the mandible, was divided into two branches in the infratemporal fossa. The deep branch of the maxillary artery was deep to the lateral pterygoid muscle and the inferior alveolar, buccal and lingual nerves, giving off the anterior tympanic, middle meningeal, anterior deep temporal, buccal, and posterior superior alveolar arteries. The deep branch passed through the pterygomaxillary fissure. On the other hand, the superficial branch of the maxillary artery, which was superficial to the lateral pterygoid muscle, gave off the inferior alveolar artery and other branches. The maxillary artery on the right side displayed a normal branching pattern within the infratemporal fossa.

These findings indicate that the deep and superficial branches of the maxillary artery remained without disappearing during the development of the maxillary artery originated from the stapodial artery.

Introduction

The maxillary artery, the large terminal branch of the external carotid artery, arises behind the neck of the mandible. It then crosses the infratemporal fossa to enter the pterygopalatine fossa through the pterygomaxillary fissure. The maxillary artery runs the superficial to the lateral pterygoid muscle in many Japanese (93.7% by Adachi¹; 89.9% by Fujita³; 90.8% by Takarada¹³; 94.0% by Kodama⁶). It has also been reported to run deep to the lateral pterygoid muscle^{2, 14} (6.3% by Adachi¹; 10.1% by Fujita³; 9.2% by Takarada¹³; 7.0% by Kodama⁶). That are frequently in Caucasians (57.6% by Adachi¹; 32.5% by Lurje¹⁰; 31.0% by Lasker et al.⁸; 44.6% by Pretterklieber et al.¹¹; 32.0% by Hussain et al.⁵). The maxillary artery has regarded that a remarkably 'racial blood vessel' in the position of the infratemporal fossa^{1, 8}. In the embryo, a vascular network in the pterygoid mass of myoblasts contributes to the formation of the maxillary artery. Afterwards, either the superficial, or, the deep part of the arterial network disappears and the remaining part as the maxillary artery, run superficial or deep to the lateral pterygoid muscle and the mandibular nerve^{4, 11, 12}. Lauber⁹ reported that case of divided maxillary arteries that run both superficial and deep to the lateral pterygoid

muscles. Since his study, however, little information of the divided maxillary artery has been provided.

The present case reports a case of the divided maxillary artery, which gave rise to deep and superficial to the lateral pterygoid muscle, and the topographical relations of the maxillary artery to the lateral pterygoid muscle and the branches of the mandibular nerve in the infratemporal fossa. Variant presence of the divided maxillary artery may reflect the embryogenesis in this area.

Material and methods

The present dissection was based on investigations in 64 specimens of Japanese cadavers that were preserved in 10% formalin in the gross anatomy dissection laboratory at Matsumoto Dental University 2007.

The maxillary arteries were dissected bilaterally using a lateral infratemporal approach. The skin was abraded from the lateral surface of the face. By removing fat and the temporal and masseter fascia, the temporalis and masseter muscles, the facial and the facial transverse arteries, the parotid gland and the plexus were dissected. The zygomatic arch was identified, and was divided at each end. The masseter muscle was reflected inferiorly with the

osteotomized zygomatic arch. While reflecting masseter, its nerve and artery were identified and then cut to allow the masseter to be reflected to the angle of the mandible. The temporalis with the coronoid process removed from the ramus of the mandible, and were reflected upwards to its origin from the temporal fossa. While reflecting temporalis muscles, its nerve and arteries were identified. Then, the pterygomandibular fossa was observed.

Afterwards, the retromandibular fossa was dissected, and the external carotid artery and the origin of the maxillary artery were identified. Then, the condylar processes were cut at the neck of the mandible, and were removed carefully from the insertion of the lateral pterygoid muscles. The muscles were also carefully removed from the infratemporal fossa. The arteries and the branches of the maxillary artery and the branches of the mandibular nerve

Fig. 1. Photograph (a) and schematic drawing (b) of the left infratemporal fossa.

The maxillary artery (Ma) arose from the external carotid artery (Eca). The deep branch of the maxillary artery (thick arrows) ran the deep layer of the lateral pterygoid muscle and gave rise to the anterior tympanic (Ata) and middle meningeal arteries (Mma). The deep auricular artery (Daa) arose from near the origin of the superior temporal artery (Sta). The middle meningeal artery (Mma) entered the foramen spinosum without branching accessory artery or branches. The deep branch ran medially to the inferior alveolar nerve (Ian), then through the lingual nerve (Ln), medially to the buccal nerve (Bn), and entered the pterygopalatine fossa. The deep branch gave rise to the anterior deep temporal (Adta), the buccal (Ba) and posterior superior alveolar arteries (Psaa) before entering the pterygopalatine fossa.

The superficial branch of the maxillary artery (thin arrows) ran superficial, branching the inferior alveolar artery (laa) and other branches. A small branch arose from the facial artery (Fa) at the lower margin of the body of the mandible and anterior margin of the masseter muscle.

The broken lines in the Fig. 1b indicate the infratemporal crest. The posterior deep temporal (Pdta) and transverse facial arteries (Tfa) originated from the common trunk.

An: auriculotemporal nerve, NI: Nerve to lateral pterygoid, V₃: mandibular nerve, SI: sphenomandibular ligament

were carefully observed and preserved possibly throughout this dissection of the infratemporal fossa.

Findings

The divided maxillary artery was found at the left infratemporal fossa. The cadaver was that of a 63-year-old male who died of heart failure.

The left maxillary artery arose from the external carotid artery at the level of the lower posterior part of the neck of the mandible. Close to its origin, the maxillary artery divided into two branches that ran deep and superficial to the lateral pterygoid muscle (Figs. 1a and b).

Of these 2 branches, the one that ran deep to the lateral pterygoid muscle was larger and passed the pterygomaxillary fissure, and it was regarded as the deep branch of the maxillary artery. The one that ran superficial to the lateral pterygoid muscle was smaller, and it was regarded as the superficial branch.

The deep branch of the maxillary artery gave off anterior tympanic artery as the first branch near the bifurcation of the maxillary artery in the mandibular part. Deep auricular artery was not observed at both the deep and superficial branches, but a tiny branch that might be regarded as the deep auricular artery, ran toward the mandibular fossa from the origin of the superficial temporal artery in the retromandibular fossa. In the pterygoid part, the deep branch of the maxillary artery gave off middle meningeal artery without branching the accessory artery or the branch and passing through the origin of the auriculotemporal nerve, and entered the foramen spinosum. Then, the deep branch of the maxillary artery passed deep to the three branches of mandibular nerve, ie, the inferior alveolar, lingual and buccal nerves, and gave rise to the buccal artery.

In the pterygopalatine part, the deep branch gave rise to anterior deep temporal artery, that gave off a branch descended to the buccal region. Then, the deep branch gave rise to the posterior superior alveolar artery that was thick and ran downward on the posterior surface of the maxilla and entered the alveolar foramina. Finally, the deep branch of the maxillary artery passed through the pterygomaxillary fissure.

The superficial branch of the maxillary artery, which ran superficial to the lateral pterygoid muscle, gave rise to the inferior alveolar artery that was thin near the bifurcation of the maxillary artery in the mandibular part. Then, the superficial branch gave off artery and branches that appeared to be the masseteric artery and pterygoid branches in the pterygoid part. The superficial branch had been cut at the pterygopalatine part and so its further observation was not possible.

In addition to the maxillary artery, the transverse facial artery arose laterally from the external carotid artery nearly perpendicularly to the origin of the maxillary

artery. The transverse facial artery gave rise to a branch, which regarded as the posterior deep temporal artery, accompanied with the superficial temporal artery to the posterior temporal region. Facial artery appeared at the lower border of the mandible, just in front of the masseteric muscle. The facial artery also gave rise to a branch that ascended toward the buccal region.

The right maxillary artery ran anteriorly superficial to the lateral pterygoid muscle, displaying a normal branching pattern and passed through the pterygomaxillary fissure in the infratemporal fossa. The other arteries arose from the external carotid artery on the right side also displayed a normal branching pattern.

Discussion

In the present case, the deep branch, which regarded as the main trunk of the maxillary artery, was deep to the lateral pterygoid muscle and the mandibular nerve. On the courses of the maxillary artery and topographical relations to the lateral pterygoid muscle and mandibular nerve in Japanese, Fujita³⁾ classified 119 maxillary arteries into 5 types. According to the classification, the deep branch as the main trunk of the maxillary artery in the present case was similar to the type E, which found 1.7% of cases. Kodama⁶⁾ classified 415 maxillary arteries into 5 types. According to the classification, the deep branch in this case was similar to the type E, which found 0.48% of cases. However, the present case differed from those in that the maxillary artery divided and also gave rise to the branch superficial to the lateral pterygoid muscle.

Lauber⁹⁾ classified 200 maxillary arteries into 6 types and reported that the incidence of double maxillary artery in 8.5% that superficial to the mandibular nerve, but superficial to the lateral pterygoid muscle. Since his report, however, there has been little information on the case of the double maxillary artery. The present case was not similar to the results provided by Lauber in that the deep branch of the maxillary artery was deep to the mandibular, lingual and buccal nerves.

In the present case, the anterior tympanic, middle meningeal, buccal, anterior deep temporal, and posterior superior alveolar arteries arose from the deep branch of the maxillary artery. On the other hand, the inferior alveolar artery and other branches arose from the superficial branch of the maxillary artery. The superficial branch of the maxillary artery appeared to supply areas not supplied by the deep branch.

The anlage of the maxillary artery forms vascular rings around the branches of the developing mandibular nerve in the embryo. Afterward, either the superficial or deep halves of the rings disappear⁴⁾. Thus, the deep and superficial branches of the maxillary artery observed in the present case were considered to be a divided, probably a double maxillary artery, remaining both halves of

the rings without disappearing.

The buccal artery and some branches to the buccal region were found in the present case. The buccal artery has been reported as the most important connection between the maxillary and facial systems. It anastomoses with the jugal trunk (cheek) of the facial artery. It is rarely seen alone; rather, it is visualised as an arch with the jugal trunk⁷⁾. The superficial branch of the maxillary artery in this case might also have been involved to connect with the trunk. Further investigations are needed to clarify the relationships between the maxillary and facial systems.

In conclusion: (1) In a 63-year-old male who died due to heart failure and routine dissection at Matsumoto Dental University in 2007, the main trunk of the left maxillary artery divided further into superficial and deep branches. (2) The main trunk of the maxillary artery, which ran deep to the lateral pterygoid muscle gave rise to the anterior tympanic, middle meningeal, buccal, anterior deep temporal, and posterior superior alveolar arteries. The main trunk ran deep to the mandibular nerve. (3) Branches arose from the superficial branch of the maxillary artery which ran superficial to the lateral pterygoid muscle, and supplied areas not supplied by the deep branch.

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