

THE MAXILLARY ARTERY – THE IMPORTANCE OF ITS TOPOGRAPHIC RELATIONS

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Abstract: The maxillary artery, terminal branch of the external carotid artery, alongside the superficial temporal artery, bears great importance in the topographical relations of the infratemporal region. Its situation can be either superficial or deep, depending on the maxillary artery's topographical relations with the lateral pterygoid muscle. This research highlights the possible variations of the artery with a maximum importance in medical practice.

Cuvinte cheie: artera maxilară, raporturi topografice, artera carotidă externă

Rezumat: Artera maxilară, ramura terminală a arterei carotide externe, alături de artera temporală superficială, are o importanță deosebită în raporturile topografice de la nivelul regiunii infratemporale. Situația acesteia poate fi superficială sau profundă, în funcție de raporturile topografice cu mușchiul pterigoidian lateral. Studiul nostru pune în evidență posibilele variații de poziție ale acesteia, cu maximă importanță în practica medicală.

INTRODUCTION

The maxillary artery is divided in three sections. The first is the mandibular section, in close topographic relations to the neck of the mandible. The second is the pterygoid section, boasting relations with the lateral pterygoid muscle, while the third is the pterygopalatine section, located in the fossa bearing the same name.(12)

Extensive knowledge of the maxillary artery, of its possible anatomical varieties, is an important element for every medical specialist dealing with manual practice on it or its immediate vicinity. The maxillary artery distributes the sanguine flow towards the maxillary, mandible and the deep regions of the face. It is therefore considered to be a vascular component whose aim is to sustain the soft and hard tissues of the maxillofacial region. It is of great importance to ensure an adequate hemostatic control of it during surgery or during superselective intraarterial chemotherapy in the cancer-related diseases of the head and neck. The diagnosis and treatment of any ailments appearing within the vascular territory of the maxillary artery are commonly based on CT angiography and MRI.(16)

A study, published by Ismihan in 2011, performed on human bodies, proved that in 57.1% of the cases, the location of the maxillary artery was superficial, while in 42.9% it was located deeply. It had therefore been determined that the maxillary artery with superficial paths crosses between the two heads of the lateral pterygoid muscle, while the maxillary artery with deep paths crosses, towards the pterygopalatine fossa, from the posterior side of the pterygoid muscles. In the entire casuistry, the authors showed that the maxillary artery had a lateral disposition to the lingual and inferior alveolar nerves. Proper knowledge of the vicinity relations of the maxillary artery is not important just for protection during surgery, but also for the capability to explain all sorts of elements and phenomena before the treatment is instituted.(15)

Terri Lynn Solomons, in a study published back in 2008, highlighted the fact that pseudoaneurisms are, usually,

treated through vascular embolisation. Concerning the particular case the author had studied, the patient was treated, successfully, through interventional embolisation in his/her left maxillary artery, after being diagnosed with pseudoaneurism of the left maxillary artery following a stab wound to his/her left ear.(17)

Samuel Ng, in a study published in 2001, speaks about transluminal percutaneous stent-angioplasty, representing a minimally invasive procedure in carotid artery stenosis. Unfortunately, it hasn't yet been approved by the FDA, therefore it is still considered experimental.(18) Neurological complications can be divided into: those that arise as a direct result of the procedure itself (inferior alveolar nerve block and posterior superior alveolar nerve block); and those due to the toxicity of the agents used. Facial nerve palsy following inferior alveolar nerve block may appear immediately or be delayed.

The patient may complain of double vision and may exhibit limitation of abduction of the ipsilateral eye as well as paraesthesia of the lateral side of the upper and lower eyelids. Deposition of anaesthetic solution within the posterior superior alveolar artery, which causes a back flow into the connecting maxillary artery and subsequently into the middle meningeal artery. There exists a constant anastomosis between the orbital branch of the middle meningeal and the recurrent meningeal division of the lacrimal branch of the ophthalmic artery. This lacrimal artery supplies the lateral rectus muscle, the lacrimal gland and the outer half of the eyelids, which, due to these anatomical considerations, may explain all the symptoms.(19)

Gaetan N, in a study published in 2001, illustrates that proper understanding of the pathophysiology of the lesion has removed ligation of the external carotid and direct surgical approaches from the current armamentarium. The endovascular techniques that replace them are not, however, without risks or complications: many minor problems or major sequelae can occur at the puncture site, along the vascular path and during injection of the occluding material. Super-selective embolization used in different ways, (as a stand-alone permanent treatment, as

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an adjunct to resection-reconstruction surgery, or in combination with a retrograde venous approach) is the current treatment of choice.(23)

The maxillary artery and its terminal branches are commonly damaged in the maxillary osteotomy, especially during separation of the pterygomaxillary junction. When properly placed, the margin of safety from the superior cutting edge of the osteotome to the maxillary artery is approximately 8 mm in adults, as Apinhasmit demonstrates in a study published in 2004.(20)

A series of procedures in maxillofacial surgery are performed in close proximity to the maxillary artery, in the infratemporal fossa. The complicated nature of anatomy makes the first two parts of the maxillary artery relatively inaccessible and direct ligation impractical. Surgical exposure of the artery without damaging the facial nerve and condylar process is difficult. The distance from the pterygoid fossa to maxillary artery is equal to the height of the decolator, which needs to be used with great precision.(21)

The maxillary artery is the most voluminous terminal branch of the external carotid artery, being distributed towards the mandible, maxilla, teeth, muscles of mastication, palate, nose and cranial dura mater. During total or radical maxillectomy, ligation of the proximal section of the maxillary artery is necessary to reduce intraoperative bleeding.(22)

PURPOSE

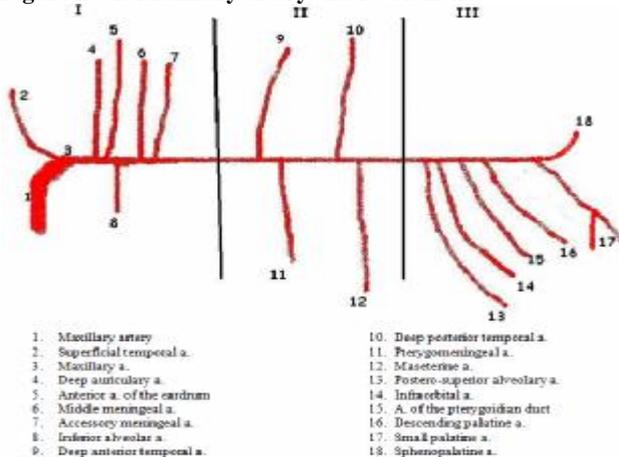
The purpose of the current study is to research the anatomical variations of the topographic relations and the branches emerging from the maxillary artery, with usefulness in surgical practice, by highlighting the anatomical clinical particularities of this very important branch of the external carotid artery.

METHODS

For this particular study we have done research on four human bodies, on every one of them having highlighted the maxillary artery alongside its branches and topographical relations. The didactic material was carefully prepared in solution containing formaldehyde, alcohol, water, glycerine, phenol - substances whose purpose is to preserve and keep the anatomical parts in proper condition for research and dissection.

We began the dissection starting from the superficial regions, highlighting the terminal branches of the external carotid artery, followed by the isolation of the branches of the maxillary artery and its relations with the neighbouring nervous and vascular elements of the infratemporal region.

Figure no. 1. Maxillary artery and its branches



RESULTS AND DISCUSSIONS

The maxillary artery features three sections: mandibular, pterygoidian and pterygopalatin. The branches emerging from the mandibular section are the deep auricular artery, the anterior artery of the eardrum, the inferior alveolar artery, the middle meningeal artery and the accessory meningeal artery.

The pterygoidian section gives birth to the pterygomeningeal artery, the masseterine artery and the posterior and anterior deep temporal artery.

The branches emerging from the pterygopalatin section of the maxillary artery are the postero-superior alveolar artery, the infraorbital artery, the artery for the pterygoidian duct, the descending palatine artery, the small palatine arteries and the sphenopalatine artery (the terminal branch of the maxillary artery).

In the first case, the situation of the maxillary artery was superficial, with lateral relations with the inferior alveolar nerve. The inferior alveolar nerve gives birth to an anastomotic branch with the lingual nerve (figure no. 1).

In the second case, the maxillary artery was disposed profoundly. It features lateral relations to the inferior alveolar nerve, which is born from two roots, both located laterally to the artery (figure no. 2).

Figure no. 2. Inferior alveolar nerve, 2. Lingual nerve 3. Maxillary nerve



The third case presents the maxillary artery in a deep situation, with medial topographic relations to the inferior alveolar nerve, which itself presents one anastomotic branch with the eardrum chord nerve (figure no. 3).

The fourth and last case comes with a lingual nerve which is in fact the most sizeable branch of the mandibular nerve. It is located right beside the inferior alveolar nerve, with medial relations to the maxillary artery, positioned superficially (figure no. 4).

Figure no. 3. 1. Lingual nerve, 2. Inferior alveolar nerve, 3. Medial pterygoid muscle, 4. Maxillary artery



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Figure no. 4. 1. Maxillary artery, 2. Inferior alveolar nerve, 3. Lingual nerve



Figure no. 5. 1. Maxillary artery, 2. Inferior alveolar nerve, 3. Lingual nerve



CONCLUSIONS

1. The first section of the maxillary artery boasts topographic relations with the neck of the mandible, where it is difficult to deal with during temporo-mandibular surgery.
2. The pterygoid section of the maxillary artery knows three possible variations of topographical relations, depending on its superficial or deep disposition.
3. In two of the case we've studied, the maxillary artery was disposed deeply, at the same time the inferior alveolar nerve and the lingual nerve being located either laterally or medially to the artery, but never on different sides of it.
4. One case featured deep situation of the maxillary artery, laterally to the inferior alveolar nerve.
5. In two of the studied cases, the maxillary artery featured superficial situation, laterally from the alveolar and the lingual nerves, and externally to the lateral pterygoid muscle.
6. The accessory branch of the middle meningeal artery emerges, in one of the cases, directly from the maxillary artery, while in the other three cases it is a secondary branch of the middle meningeal artery.
1. Our study confirms the complexity of the topographical relations between the maxillary artery, its branches and the branches of the trigeminal nerve.

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