

Surgically important neurovascular structures related to the submandibular gland.

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Abstract

Introduction

The pathologies and procedures of the submandibular gland are numerous. Comprehensive knowledge of the anatomy and its relations of the SMG will avoid iatrogenic injuries within the submandibular triangle. This study assesses the presence and frequency of neurovasculature related to the SMG with special interest on the facial artery and the marginal mandibular nerve of cranial nerve (CN) VII

Methods

In twenty- five fresh cadavers, right and left side SMG (n=50) were dissected and observed in the department of Anatomy, faculty of Medicine, Ragama. Data were recorded on frequency of facial artery and postsynaptic sympathetic periarterial plexus and the marginal mandibular nerve of CN VII with relations to the SMG.

Results

The majority 40/50 had the facial artery placed on the posterior surface of the SMG outside the capsule of the gland. Two of those specimens (2/10) had the e facial attires piercing through the parenchyma of the SMG. All facial artery anomalies were found to be present unilaterally, mostly on the right side and mainly among the females. 3/50 female cadaveric specimens had the marginal mandibular nerve of CN VII nerve traversing through the superficial part of the SMG. All of them were in the right side.

Conclusions

The data indicate a higher rate of aberrant submandibular neurovasculature were on the right side with a female preponderance.

Introduction

The submandibular triangle is demarcated by the inferior border of the mandible and the anterior and posterior bellies of the digastric muscle. The superficial and deep surfaces are formed by the platysma and the mylohyoid muscle, respectively [1]. The submandibular gland (SMG) is in the submandibular triangle. The pathologies and procedures of the SMG are varied and numerous [2-5] Comprehensive knowledge of the anatomy and its relations of the SMG will avoid iatrogenic injuries within the submandibular triangle.


Variation of the facial arterial pathway in relation to SMG has not been very well established. In majority, the facial artery is on the posterior surface of the gland and outside the capsule of the SMG. However, anomalies may divert the facial artery course within the parenchyma of the gland. This may result the facial artery and the postsynaptic sympathetic periarterial plexus that travers on its external surface at risk of iatrogenic injuries during surgical procedures. The other important structure related to the SMG is marginal mandibular branch of the facial nerve [6]. This is also at risk of an iatrogenic damage due to close relation to the SMG. This study assesses the presence and frequency of neurovasculature related to the SMG with special interest on the facial artery and the marginal mandibular nerve of CN VII.

Table 1: Anomalous facial artery and marginal mandibular branch

| Category | Facial artery variants | CN VII - marginal mandibular branch variants |
|----------------|------------------------|--|
| Male | 3 | 0 |
| Female | 7 | 3 |
| Left | 2 | 0 |
| Right | 8 | 3 |
| Total variants | 10 | 3 |

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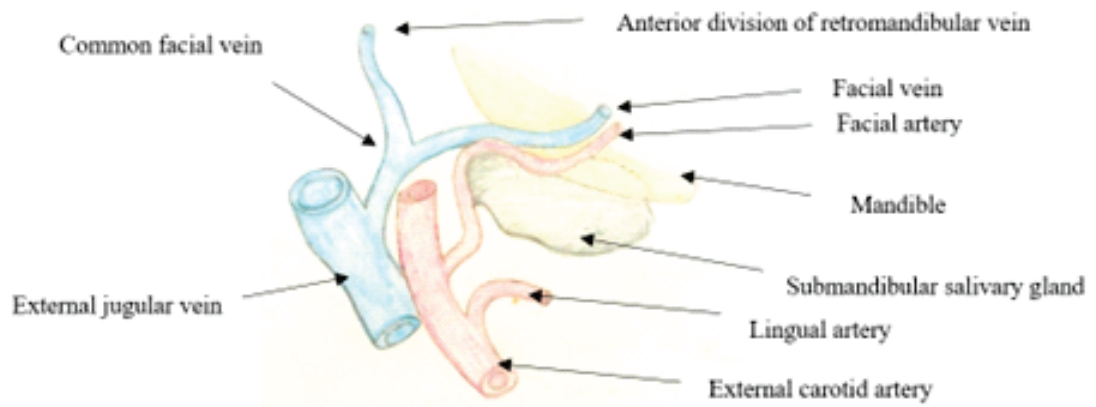


Figure 1. Normal anatomy of the Submandibular gland



(A)



(B)

Figure 2. Anatomical variants of the facial artery within the submandibular gland

(A) Lateral view of the Right-side SMG which has no facial artery anomaly; (B) Anatomical variant of the right SMG which facial artery piercing the SMG and dissected Right submandibular gland to visualize piercing facial artery.

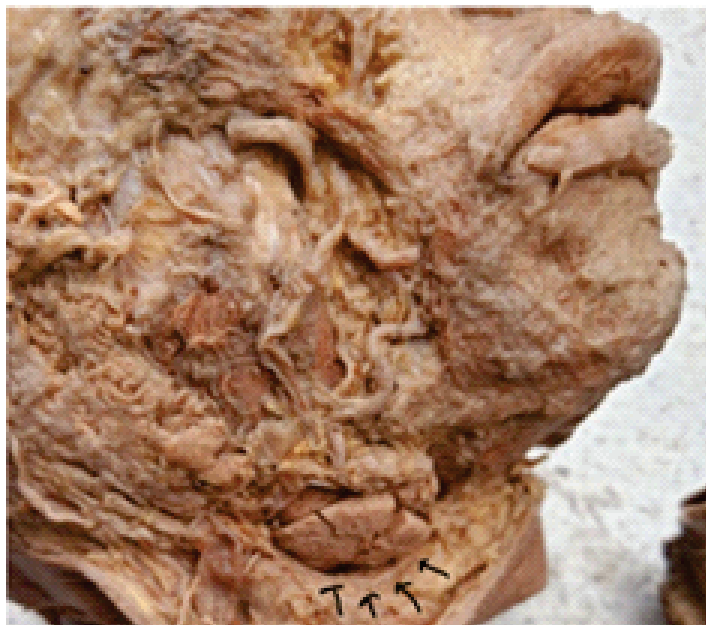


Figure 2. Dissected and retracted downwards marginal mandibular nerve is marked in black arrows

Method

In twenty-five fresh cadavers (13 M/ 12 F) right and left side SMG (n=50) were dissected and observed in the department of Anatomy, faculty of Medicine, Ragama. Data were recorded on frequency of facial artery and postsynaptic sympathetic periarterial plexus and the marginal mandibular nerve of CN VII with relations to the SMG. Nature of the study did not warrant any ethical clearance. No conflict of interest was declared.

Statistical Analysis

Social Science Statistical Package (SPSS Inc., Chicago, IL, USA) computer software was used for the statistical analysis. The descriptive data were presented as mean, standard deviation and range.

Results

Among the 50 dissected specimens, majority 40/50 had the facial artery placed on the posterior surface of the SMG outside the capsule of the gland. In 10/50 specimens' facial arteries were encapsulated by the SMG. Two of those specimens (2/10) had the facial arteries piercing through the parenchyma of the SMG. All facial artery anomalies were found to be present unilaterally and majority were in the right side (8/10 R/S, 2/10 L/S). It was further observed that 7/10 specimens that had anomalous facial arteries were of females.

With reference to the marginal mandibular nerve of CN VII with relations to the SMG, 3/50 female cadaveric specimens had the nerve traversing through the superficial part of the SMG. All of them were in the right side. Overall, it was observed that right side was more associated with anomalies with a female dominance. (Table 1) (Figure 01). Rest of the cases the nerve traversed below the angle of the mandible and inferior to the platysma. Initially it was superficial to the upper part of the digastric triangle and then turned towards the cephalic direction and ran across the body of the mandible to supply muscles of the lower lip.

Discussion

Anatomical knowledge of the facial artery in relation to the SMG is vital in surgery. Clinical importance of the knowledge of facial artery and its anomalous pathways have been highlighted in relations to many surgical and interventional procedures related to the SMG [7], which includes significant concerns over the location of the facial artery and its penetrating branches, due to the interventions associated risks, such as formation of pseudoaneurysm with inaccurate needle placement following botulinum injection or from trauma to vessels of the neck and face [8]. Furthermore, the facial artery may be sacrificed in surgeries, for advancement, visualization, or mobilization [9]. Due to the amount of

collateral blood flow, removal of the facial artery has no clinical effect. However, knowledge of this piercing variant is important after trauma or locally invasive neoplasm as the facial artery may be used for facial flaps in reconstructive procedures. The previously accepted anatomical pattern of the submandibular triangle presumed that the facial artery courses via a posterior canal alongside the SMG. Our study showed that 20% specimens' facial arteries were encapsulated by the SMG. Two of those specimens 2/10 had the facial arteries piercing through the parenchyma of the SMG. All facial artery anomalies were found to be present unilaterally and majority were in the right side (8/10 R/S, 2/10 L/S). It was further observed that 7/10 specimens that had anomalous facial arteries were of females.

The marginal mandibular which supplies the muscles of the lower lip, is considered most at risk of iatrogenic injury during the surgical procedures involving the SMG [6]. In our study mostly, the nerve was below the angle of the mandible and deep to the platysma. Following its superficial course in the digastric triangle, the nerve ran upwards and crossed the body of the mandible to supply the lower lip muscles. In our study, in 3/50 female cadaveric specimens had the nerve traversing through the superficial part of the SMG. Therefore, in order to avoid and iatrogenic injury to the marginal mandibular nerve, placing an incision 2 cm or below from the lower margin of the mandible is safe. [6-8]

For SMG related surgical procedures, an understanding of the neurovascular anomalies would allow for appropriate planning and risk benefit consideration. To better understand the prevalence of aberrant anatomy related to the SMG, further studies are recommended especially on live subjects during SMG related procedures to assess rates of anatomical variance.

Conclusions

This study revealed a high frequency of anomalous facial artery patterns. The data also indicate a higher rate of aberrant submandibular neurovasculature were on the right side with a female preponderance.

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