Case Report

An anatomical variant of the posterior branch of the great auricular nerve: A case report and a short review of the literature

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ABSTRACT

The great auricular nerve (GAN) is a sensory cutaneous nerve, which provides sensory innervation to the skin overlaying auricle, parotid gland, and mastoid region. The emergency of GAN is located at Erb's point over the posterior burden of the belly of the sternocleidomastoid muscle (SCM). During its course, it normally bifurcates in a pair of, respectively, posterior and anterior, branches. The latter one then further divides into superficial and deep branches. Some different anatomical patterns of GAN branches were reported in the literature to underline the high variability of the GAN course. The aim of this case report is to underline a particular anatomical variant of a posterior branch of GAN we recently observed. It was characterized by an anomalous bifurcation involving two different groups of fibers, within the same field of innervation, which had an independent course toward the auricular lobe. To promptly face such a somewhat unexpected anomaly, besides the basic recommendation to surgeons of mastering a good knowledge of the high variability of the anatomy of GAN, a careful dissection around the SCM is believed to help the surgeon to recognize other anatomical variants of GAN course with the aim to preserve it.

Key words: Cervical plexus, Erb's point, Great auricular nerve, McKinney's point, Neck anatomy

The great auricular nerve (GAN) is a sensory cutaneous nerve, which provides sensory innervation to the skin of the auricle, as well as, the area overlaying the parotid gland and mastoid region. GAN originates from the second and third cervical nerves (C2-C3) of the cervical plexus, which is a complex structure formed by the ventral primary divisions of the first four cervical nerves. The plexus is anterolateral to the levator scapulae and medial scalene muscles and deep to the sternocleidomastoid muscle (SCM) [1]. The emergency of GAN is located at Erb's point, which is located at the level of the cricoid cartilage following the posterior burden of the belly of the clavicular head of the SCM. Its course proceeded superiorly and obliquely toward the ear and it was located behind the external jugular vein. During its course, the GAN is bifurcated into a posterior branch and an anterior one [2-4]. The posterior branch provides sensation to the skin overlaying the mastoid process and the posteroinferior area of the auricle, including the lobule and concha [4]. The anterior one is then further divided into the superficial and deep branches [3,4]. The superficial branch is distributed to the skin and surface of the parotid gland, whereas the deep branch enters the parenchyma of the parotid gland. Altafulla *et al*. [5] performed a morphological cadaveric study of the GAN analyzing its measurement and relationship with other proximal structures. The mean length of the GAN was 74.8 mm. The mean diameters of its distal, middle, and proximal portions were 1.51 mm, 1.3 mm, and 1.58 mm, respectively. The mean distances from the inferior border of the mastoid process to the GAN, the inferior border of the ear to the GAN, and GAN to the external jugular vein were 27.71 mm, 31.03 mm, and 13.2 mm, respectively. Min HJ *et al*. [6] described a classification of the branches' patterns of the GAN. They were classified into five different categories: Type I is defined by a deep branch that arises from the anterior branch; in Type II all branches originate at the same point; Type III is characterized by a deep branch which arises from the posterior one; Type IV highlights a superficial branch which arises from the posterior one; and finally Type V is reported by the anterior and posterior branches which present an independent course. The literature defines that a relationship between GAN sacrifice and the incidence of post-operative sensory disturbance was reported, but it was not significant. However, the suggestion is given to advocate for GAN preservation to reduce the incidence

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of post-operative sensory disorder. As well, a good knowledge of the high variability of the anatomy of GAN is recommended.

This case report aimed to underline a particular anatomical variant of the posterior branch of GAN we recently observed. It was characterized by an anomalous bifurcation involving two different groups of fibers, within the same field of innervation, which had an independent course toward the auricular lobe. Out of our experience, we deem a valuable recommendation to share with surgeons is that a careful dissection around the SCM may help to recognize the anatomical variants of the GAN course with the aim of preserving it.

CASE REPORT

A man of 45 years with a right superficial parotid mass underwent parotidectomy on November 06, 2023, at "Spirito Santo" Hospital of Pescara.

Surgical intervention was done by an equipe made up of three different otolaryngologists (C.C., P.G., and F.C.). The magnetic resonance imaging (MRI) highlighted a rounded mass measuring 1.2 cm in greatest dimension, with well-defined borders located in the superficial lobe of the parotid gland (Fig. 1). The main surgeon C.C. started the procedure through the modified Blair incision. The incision was created starting at the pre-auricular area, above the level of the zygomatic arch, with a posterior extension to the mastoid to enable full mobilization of the tail of the parotid and an inferomedial extension toward the hyoid in the neck skin crease. The following step consisted of the flap elevation at a slightly deeper plan, just above the superior to periparotid fascia. Skin, subcutaneous tissue, and the superficial musculoaponeurotic system (SMAS) fascia compose the flap. To preserve the posterior branch of the GAN, the surgeon had identified the emergency of GAN over the posterior burden of SCM at Erb's point, which was recognized as a particular anatomical variant of the posterior branch of the GAN. At the emergency point, the GAN trunk is divided into an anterior branch and a posterior one. The latter branch was characterized by an anomalous bifurcation with two different nerves that had an independent course toward the auricular lobe (Fig. 2a and b). The surgeon preserved both of them to avoid cutaneous sensory disturbances. Parotidectomy was regularly completed keeping the integrity of nervous branches of the facial nerve without intraoperative complications. The final diagnosis of the surgical specimen was pleomorphic adenomas.

During hospitalization, the patient did not show facial nerve paralysis, nor any discomfort in the periauricular skin area related to GAN. The patient was discharged from the hospital after 2 days of hospitalization. The surgical aim of mass removal was achieved with the preservation of the facial nerve and the posterior branch of GAN. Nowadays, 1 month postoperatively, the patient is currently free of disease.

DISCUSSION

The GAN can be stressed during some surgical procedures, such as parotidectomy, rhytidectomy, glomus tumor removal,

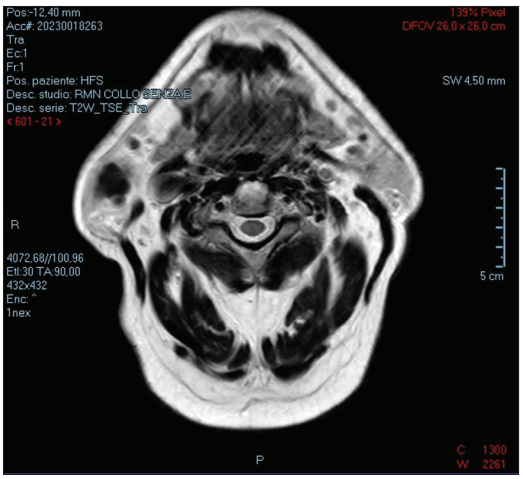

Figure 1: Radiological features of parotid's mass

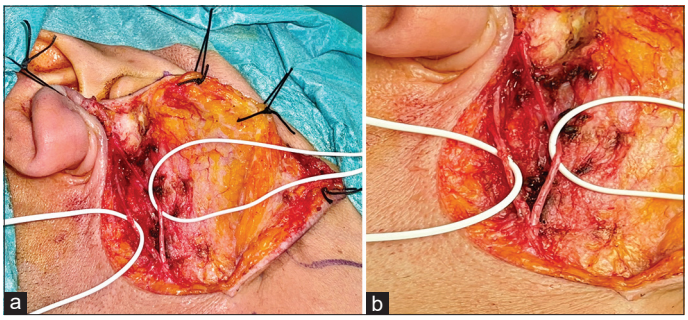

Figure 2: (a) At the emergency point the great auricular nerve (GAN) trunk divided into an anterior branch and a posterior one. The latter one was characterized by an anomalous bifurcation with two different nerves that had independent courses toward the auricular lobe; (b) An enlarged image of the anomalous bifurcation of GAN

neuromodulation for neuralgia treatment, trigeminal, and facial nerve repairs. Therefore, a thorough understanding of its anatomy is relevant in avoiding iatrogenic injury because it can be used for grafting and microsurgical repair of numerous nerve injuries caused by trauma [5].

Other uses for the GAN as a donor nerve include mandibular reconstruction and lip sensation restoration, reconstruction of the recurrent laryngeal nerve as well as of the accessory nerve [7]. Benkhatar *et al*. [8] reported the use of the GAN for corneal neurotization as a treatment option for neurotropic keratopathy resulting in reinnervation of the cornea and recovery of ocular sensation.

Clinically, iatrogenic or inevitable amputation of the GAN would incur significant complications such as dysesthesia or allodynia in the involved skin area, otalgia, discomfort on cold exposure, and neuralgia, thus identifying the most common complaints after parotidectomy with cutaneous sensory disturbances. These have often been attributed to disruption of GAN fibers of the posterior branch, while typically being observed in the pre-auricular, post-auricular, and lobular areas.

Many authors assessed the feasibility of the preservation of the posterior branch of the GAN during standard parotidectomy [9]. On the other hand, different researchers stressed that the GAN might be sacrificed because spontaneous recovery occurs, and

on average, impairments do not affect daily activities [9]. Porter and Wood [10] made a comparison between two different groups of patients with GAN sacrifice and without GAN sacrifice, respectively. They reported that the area of sensory loss showed no differences between the groups and that it decreased exponentially in both groups, as well as most of the improvements occurred within months of surgery. According to them, preservation of the posterior branches of the GAN was not necessary.

Sagalow *et al*. [11] reported the largest series available to date of post-operative sensory disturbances in 305 patients who underwent parotidectomy as it relates to intraoperative GAN sacrifice. Although the relationships between GAN sacrifice and the incidence of post-operative sensory disturbances and their subsequent resolution were not significant, they advocate GAN preservation to reduce the incidence of post-operative sensory disturbances.

However, the high variability of the course of GAN branches adds some difficulties to neck dissection, and the risk of GAN damage is frequent. To limit such a risk, it is mandatory to have a deep knowledge of the GAN course and the variability of anatomical patterns of posterior and anterior branches [6].

The case report was characterized by a bifurcation of the posterior branch of the GAN near GAN emergency over the posterior burden of SCM. Min HJ *et al*. [6] described five different categories of anatomical patterns of GAN branches. A deep branch that originated from the posterior branch of the GAN falls within the III type of pattern and its presentation is rather similar to the one discussed above in this report. The substantial difference compared to the III-type pattern of the GAN branch was related to the presence of two different posterior branches instead of a single one. Therefore, the patient exhibited an anterior branch that was regularly divided into a superficial branch and a deep branch, as reported in the first category according to Min HJ *et al*. [6].

GAN is not usually visualized by means of routine radiological images, such as magnetic resonance images and computed tomography. However, some authors point out the rule of ultrasound on small cervical nerves including the GAN [12]. For this reason, MRI did not describe the reported anatomical variant of GAN, which can only be recognized in the intraoperative setting.

In conclusion, some key points may be focused on. The GAN is always situated lateral to the external jugular vein, a useful landmark as this vein is often visible externally. The classical location for identifying the nerve is described as McKinney's Point, located midway alongside the SCM 6.5 cm inferior to the external auditory canal. Erb's point describes the emergency of GAN, which is located at the level of the cricoid cartilage following the posterior burden of the belly of the SCM. The GAN is situated deep to the cervical fascia overlaying the SCM and the lateral platysma. The cervical fascia overlaying the SCM is in continuity with the SMAS of the cheek.

CONCLUSION

According to the literature, GAN preservation might be assessed during surgical dissection of the neck. In the case of the GAN having to be divided or its preservation fails, the patients report a good recovery over time, and they consider their temporary sensory impairments not severe.

A good knowledge of the GAN course and the high variability of anatomical patterns of its branches are recommended. Despite that, a careful dissection around the SCM helps surgeons to recognize other anatomical variants of the GAN course with the aim to preserve it.

REFERENCES

1. Berry M, Bannister LH, Stranding SM. Nervous system. In: Ban-Nister LH, Berry MM, Collins P, Dyson M, Dussek JE, FergusonMW, editors. Gray's Anatomy. 38th ed. New York: Churchill Livingstone; 1995. p. 901-1937.
2. Alberti PW. The greater auricular nerve. Donor for facial nerve grafts: A note on its topographical anatomy. Arch Otolaryngol 1962;76:422-4.
3. Ozturk CN, Ozturk C, Huettner F, Drake RL, Zins JE. A failsafemethod to avoid injury to the great auricular nerve. Aesthet Surg J 2014;34:16-21.
4. Standring S. Gray's Anatomy. 40th ed. Edinburgh: Churchill Livingstone, Elsevier; 2008.
5. Altafulla J, Iwanaga J, Lachkar S, Prickett J, Dupont G, Yilmaz E, *et al*. The great auricular nerve: Anatomical study with application to nerve grafting procedures. World Neurosurg 2019;125:e403-7.
6. Min HJ, Lee HS, Lee YS, Jeong JH, Cho SH, Lee SH, *et al*. Is it necessary to preserve the posterior branch of the great auricular nerve in parotidectomy? Otolaryngol Head Neck Surg 2007;137:636-41.
7. Yoshimura H, Ohba S, Nakamura M, Sano K. Mandibular reconstruction using iliac bone and great auricular nerve grafts and oral rehabilitation using osseointegrated implants in a patient with a large ossifying fibroma: A 10-year follow-up study. J Oral Maxillofac Surg 2013;71:2176-88.
8. Benkhatar H, Levy O, Goemaere I, Borderie V, Laroche L, Bouheraoua N. Corneal neurotization with a great auricular nerve graft: Effective reinnervation demonstrated by *in vivo* confocal microscopy. Cornea 2018;37:647-50.
9. Patel N, Har-El G, Rosenfeld R. Quality of life after great auricular nerve sacrifice during parotidectomy. Arch Otolaryngol Head Neck Surg 2001;127:884-8.
10. Porter MJ, Wood SJ. Preservation of the great auricular nerve during parotidectomy. Clin Otolaryngol Allied Sci 1997;22:251-3.
11. Sagalow ES, Givens AK, Gill K, Malkani K, Xu V, Elmer N, *et al*. Impact of great auricular nerve sacrifice on sensory disturbance after parotidectomy. Am J Otolaryngol 2022;43:103387.
12. Meng S, Platzgummer H, Loizides A, Chang KV, Gruber H. Ultrasound of small nerves. Ultraschall Med 2022;43:12-33.

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