Borle's triangle: A reliable anatomical landmark for ease of identification of facial nerve trunk during parotidectomy

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ABSTRACT

Purpose: An accurate understanding of the anatomy, identification and preservation of facial nerve is critical in performing successful functional parotidectomies. The current literature is replete with inconsistencies of various landmarks when used alone for identification of facial nerve trunk (FNT). The purpose of the paper is to introduce a new anatomical triangle, Borle's triangle (BT) for safer and reliable operative identification of FNT during parotidectomies.

Patients and methods: Between Aug 2014 and Dec 2017, twelve patients who reported with unilateral disease of the parotid gland with intact facial nerve function who underwent superficial or complete parotidecomies were included in the study. BT was conceptualized by intersection of three imaginary lines drawn along anatomical structures and forming a triangle comprising of angles a, b and c.

Results: Introperatively, BT helped reliably identify the FNT and its branches successfully in all the cases. The mean distance of FNT from angle b was found to be 12.18 ± 1.7 mm. Transient neurological deficits with one or more branches were seen in four cases whilst, one case had transient deficit with all the five peripheral branches. All of them spontaneously resolved completely by the end of three months post operatively.

Conclusions: When used in isolation, substantial variations exist in distances measured from anatomic landmarks to the main FNT in the literature. The BT utilizes three commonly used anatomical landmarks. It predictably helps in proper anatomic orientation, identification and preservation of FNT and branches with ease in parotidectomies.

1. Introduction

The facial nerve along its extracranial course, passes through the glandular substance of the parotid gland (PG) and hence vulnerable to injuries during parotidectomies. A comprehensive knowledge of its anatomy and meticulous dissection are the keys for identification of facial nerve trunk (FNT) and its branches which are crucial in preventing permanent functional impairment and medico-legal implications. During parotidectomies, the two classical approaches in identifying the FNT described are the conventional antegrade and retrograde dissection. To aid in early operative identification of FNT, various soft tissue and bony landmarks have been proposed. Frequently used anatomical landmarks are the tragal pointer (TP),[1] the tympanomastoid suture,[2] the posterior belly of digastric, (PBD)[3] the styloid process, (SP)[4] and retromandibular vein.[5] Though these have been extensively discussed in literature, however, it lacks convincing evidence of

establishing superiority of an individual landmark when compared to others.[6]

The consistency of soft tissue landmarks are influenced by age, previous surgery, intrinsic scarring and the extent of the existing pathology.[7] Bony landmarks have been considered as the most reliable anatomical guides owing to their rigid and consistent location.[8] However, recently variability and discrepancy between the two sexes while using some of the bony landmarks have been reported.[9,10]

This marked ambiguity and controversy amongst surgeons regarding the operative accuracy and precision of these bony and soft tissue landmarks led the senior author propose an anatomical triangle for ease of identification of FNT during parotid surgeries. The aim of the present paper was to introduce a new anatomical triangle using the some of the commonly used landmarks for safe, easy and reliable way of identifying FNT.

2. Patients and method

The present study included 12 patients with unilateral PG pathology that underwent unilateral superficial parotidectomies for benign and malignant pathologies affecting parotid glands by the same surgical team during Aug 2014 to Dec 2017 at our institute. All procedures performed in the study were in accordance with the ethical standards of the institution and the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Institutional ethical committee clearance was obtained for this study. Detailed written informed consent conveying all possible complications with emphasis on facial nerve palsy was obtained from the patient. Preoperatively, all patients were evaluated by 1.5 T contrast Magnetic Resonance Imaging (MRI) for the extent of the disease. Fine needle aspiration cytology (FNAC) was carried out to ascertain the diagnosis. 10 patients were diagnosed with benign salivary gland tumors (5 pleomorphic adenomas, 3 Warthin's tumour, 1 case each of oncocytoma, and chronic nonspecific sialadenitis of the PG), whilst the disease in the remaining two cases were found to be malignant in nature (1 case each of Muco epidermoid carcinoma and Carcinoma ex pleomorphic adenoma).

2.1. Method

Under general anesthesia, in supine position, with adequate extension at neck the subject's head was turned to the opposite direction. Following standard preparation of the surgical site with a suitable antimicrobial solution, the surgical site was accessed using Modified Blair's lazy S incision. A skin flap was raised in a sub platysmal plane in the cervical region and along the superficial musculo aponeurotic (SMAS) layer over the PG to expose the parotid capsule in the preauricular area. Dissection in the same plane was continued to expose the PG anteriorly and the anterior border of the sternocleidomastoid muscle (SCM) posteriorly. At all point of time, care was exercised to avoid perforation of skin flap.

The anterior border of the SCM was used to identify the tail of the PG. Sharp dissection was continued to separate the tail of the PG off the SCM and also from the cartilaginous external auditory canal. The greater auricular nerve coursing superficially on surface of the SCM was identified and divided as close to the PG as possible in an effort to preserve the posterior branch which if required may serve as a potential nerve graft if needed. The superficial lobe of the gland was gently retracted medially and the blunt dissection was accomplished at the posterior border of the gland. The skeletonized anterior border of SCM was retracted laterally to expose the PBD muscle which was then visualized.

2.2. Outlining of Borle's triangle

A first line was marked with the ink starting from the tip of the mastoid process, running along the superior border of the PBD. Posterior border of the ramus of the mandible was then palpated and second line was drawn along the posterior border of the ramus. These two lines intersect with each other anteriorly, forming the apex of the triangle (angle a). The base of the triangle is marked by drawing the third line starting from the tip of the mastoid process, (angle b) running anteriorly, till it joins the second drawn line along the posterior border of the ramus (angle c). The FNT is often found within this triangle just above the angle b formed by the 1st and the 3rd line if gentle and blunt dissection is carried out at this point (Figs. 1 and 2). The facial nerve is seen as white and glistening structure. The mean distance of FNT from the angle b was 12.18 ± 2 mm within a range of 9–15 mm. The use of tragal pointer helps in locating the FNT during the dissection. The dissection was carried out in an antegrade manner following the FNT to reach the *pes anserinus*. Thereafter, using bipolar cautery and blunt dissection, the cervicofacial and temporofacial divisions were exposed and the 'pes anserinus' dissected while bluntly lifting off the superficial
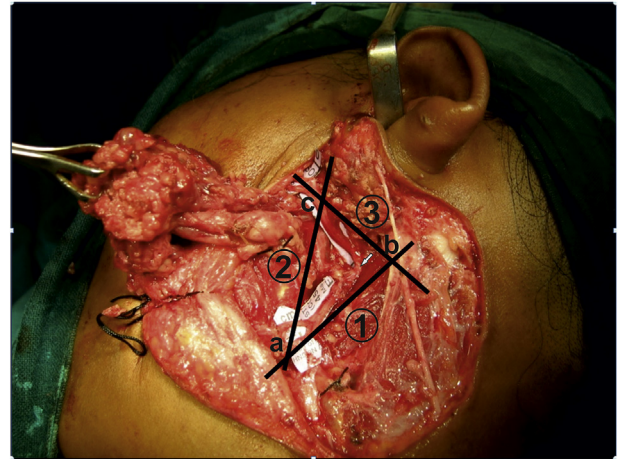

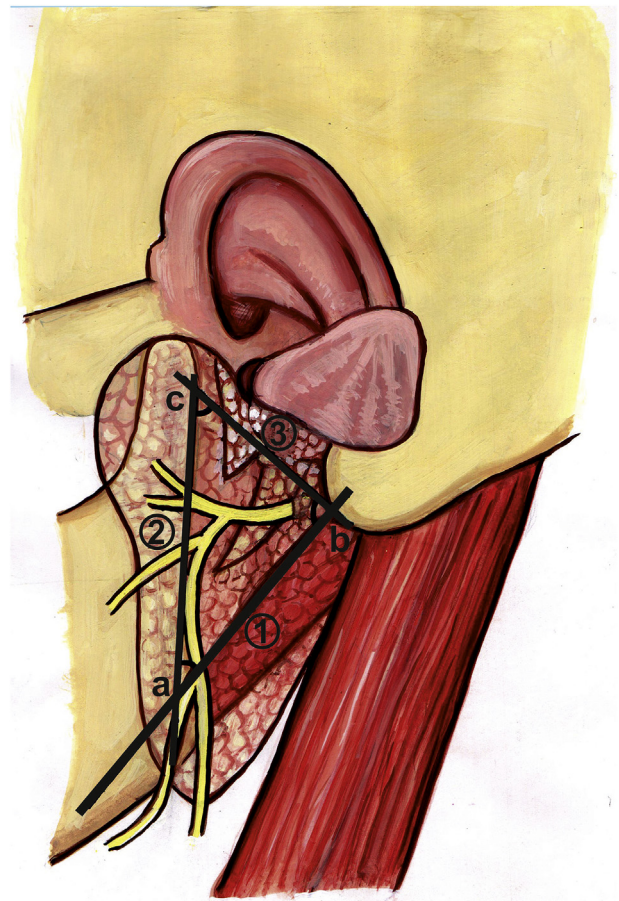**Fig. 1.** Outlining of Borle's Triangle for identification of facial nerve trunk.

Fig. 2. Diagrammatic presentation of Borle's Triangle.

lobe of the PG from the nerve branches. In total parotidectomy cases, after delivering the superficial lobe, the FNT along with the nerve branches were gently lifted up and the deep lobe of the PG was dissected and removed. After achieving hemostasis, a closed circuit suction drain was secured and layer wise closure done with 3-0 vicryl and subcuticular suturing of the skin with 3-0 prolene. Pressure dressing was applied over the surgical area and parenteral antibiotics and analgesics were instituted.