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REVIEW PAPER

The fallopian canal: a comprehensive review and proposal of a new classification

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Abstract
Introduction The facial nerve follows a complex course through the skull base. Understanding its anatomy is crucial during standard skull base approaches and resection of certain skull base tumors closely related to the nerve, especially, tumors at the cerebellopontine angle.
Methods Herein, we review the fallopian canal and its implications in surgical approaches to the skull base. Furthermore, we suggest a new classification.
Conclusions Based on the anatomy and literature, we propose that the meatal segment of the facial nerve be included as a component of the fallopian canal. A comprehensive knowledge of the course of the facial nerve is important to those who treat patients with pathology of or near this cranial nerve.

Keywords Fallopian canal · Anatomy · Skull base · Facial nerve · Neurosurgery

Anatomy

The facial nerve has motor, sensory, and parasympathetic components. The sensory component is contained in the nervus intermedius, which also transmits the special sense of taste where its signals are relayed to the gustatory nucleus. The parasympathetic component emerges from the superior salivatory nucleus, also carried in the nervus intermedius, and supplies the sublingual, submandibular, nasomucosal, and lacrimal glands. The motor component innervates muscles of facial expression and arises from the primary facial nucleus in the pontine tegmentum in the floor of the fourth ventricle [1].

The facial nerve has six described segments: cisternal, meatal, labyrinthine, tympanic, mastoid, and extracranial [1]. The fallopian canal is a z-shaped bony channel in the temporal bone that runs from the distal internal acoustic meatus to the stylomastoid foramen and carries parts of the facial nerve (Fig. 1).

Cisternal segment

The first part of the facial nerve is the cisternal segment, which travels from the brain stem to the internal auditory canal (IAC) through the subarachnoid space. The facial nerve usually merges with the nervus intermedius at the pontomedullary sulcus and traverses the cerebellopontine subarachnoid confluence [1]. The nerve travels through the cerebellopontine angle cistern for 20 to 25 mm before entering the IAC. With current imaging techniques, it is difficult to distinguish the facial from the nervus intermedius component in this segment [1–3].

Through its course within the cerebellopontine angle, the cisternal part of the facial nerve lacks an epineurium and is invested directly with pia mater. Although they leave the brain stem separately, the facial nerve joins and runs together with the cisternal segment of vestibulocochlear nerve [1, 4]. In 1998, Hyun-Sook et al. [5] studied the anatomical and MRI relationship between the facial and vestibulocochlear nerves. They found that in 57 % of dissections and 67 % of MR

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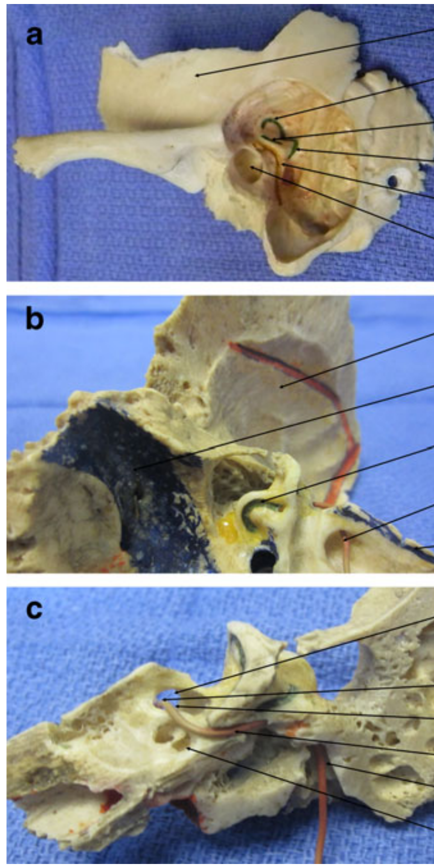

Fig. 1 **a** Cadaveric dissection of the temporal bone (lateral view) showing the bony labyrinth and course of the fallopian canal (*orange line*). **b** Cadaveric dissection of the temporal bone (medial view) showing the internal acoustic meatus and course of fallopian canal. **c** Cadaveric dissection of the temporal bone (anterior view) showing the course of the fallopian canal (*orange line*)

images, the cisternal segment was anterior to the mid-portion of the vestibulocochlear nerve.

Meatal segment

The second segment of the facial nerve begins at the IAC and ends at the end of the IAC; the fundus. The facial nerve enters the IAC along with the vestibulocochlear nerve, where it assumes a similar relation to that within the cerebellopontine angle [1]. Rubinstein et al. [6] studied the facial and vestibulocochlear nerves and found that the facial nerve lies mainly anterosuperior but may be in a superior or anterior position. In the lateral part of some specimens, however, the facial nerve could not be separated from the superior vestibular nerve. This might be related to the various amounts of fibrous tissue along the nerves within the canal or to the presence of nerve fibers that connect the two nerves [6]. On the other hand, a study by Tian et al. [7] revealed different degrees of rotation between the facial and vestibulocochlear nerves within the canal. They reported an anteroinferior rotation of the facial nerve in relation to the vestibulocochlear nerve from the bottom of the IAC to the porus acusticus in 63 % of the cases. In the same study, the authors also reported an 83 % incidence of vestibulo-facial anastomoses. In most cases, these anastomoses were in the medial third of the canal, and were either single or multiple [7].

The crista falciformis, also known as transverse crest, is a bony ridge that divides the fundus into a superior and inferior portion of variable depths. The facial, intermedius, and superior vestibular nerves are above the crista with the facial nerve and nervus intermedius being anterior to the superior vestibular nerve. The cochlear and inferior vestibular nerves are below the crista, with the cochlear nerve found anterior to the inferior vestibular nerve [1, 8]. Bill's bar is a triangular vertical ridge that subdivides the fundus of the IAC into anterior and posterior portions [9, 10]. Hence, the facial and cochlear nerves are anterior to Bill's bar and the superior and inferior vestibular nerves are posterior to it. Bill's bar has a triangular shape, with the base located laterally, thus, the nerves become more separated as they move from medial to lateral [11]. This bar constitutes an important landmark to differentiate the nerves within the IAC. On cross section, the fundus is divided into four quadrants. The facial nerve and nervus intermedius are anterosuperior, the superior vestibular nerve is in the posterosuperior, the cochlear nerve is in the anteroinferior, and the inferior vestibular nerve is in the posteroinferior positions [1, 8].

An arterial meatal loop is found in the cerebellopontine angle, and its presence may be extrameatal (of which no part of the loop extends within the IAC), at the opening of the IAC (in which the dome of the loop is present within the canal), or intrameatal (in which the loop extends within the IAC)

[12, 13]. According to a study by Mazzoni et al. [13], the meatal loop represented the main stem or a branch from one of the following: AICA in 80 % of the cases; accessory AICA that arises from the basilar artery a few millimeters distal to the AICA in 17 % of the cases; or PICA in 3 % of the cases. When the meatal part assumes an extrameatal course that is not related to the IAC, the loop commonly lies close to the petrous bone, passing with its curved segment at the undersurface of the vestibulocohclear nerve, while the proximal and recurrent limbs assume very variable courses in relation to the nerves. In cases with a canal-related position of the meatal loop, 30 % of the loop runs between the facial and vestibulocochlear nerves. The recurrent limb is found on the superior surface of the vestibulocochlear nerve and is in part, covered by the facial nerve. The proximal limb is located between the facial nerve and the anterior wall. In 17 % of the cases, the loop lies under the nerves and on the floor and lower edge of the canal. In 8 %, the loop lies in a frontal plane between the nerves and the anterior wall. In 5 % of the cases, the loop lies in a vertico-frontal plane between the nerves and the posterior wall of the canal. Only rarely, in 1 % of cases, the loop is found above the nerves and is in contact with the roof of the canal. In 9 % of the cases, the meatal loop has such an individual course as to be unclassifiable (6 % related, 3 % unrelated to the canal) [13]. Once the facial nerve leaves the IAC, the two components of the nerve (facial nerve and nervus intermedius) pierce a small, bony foramen [14] and continue into the fallopian canal (i.e., facial canal).

Labyrinthine segment

The first part of the facial canal and the third part of the facial nerve comprise the labyrinthine segment, with a mean length of only 3 to 5 mm [1, 8]. It moves laterally and slightly anteriorly through a curve ending at the geniculate ganglion where the nervus intermedius separates from the facial nerve. The greater petrosal nerve originates from the nervus intermedius at the geniculate ganglion (Fig. 2). However, the fibers do not synapse within the geniculate ganglion. It supplies parasympathetic fibers to the lacrimal and the nasomucosal glands [1, 8]. The labyrinthine segment lies beneath the middle cranial fossa, and courses perpendicular to the axis of the temporal bone [1]. It is related to the first cochlear turn anteriorly, to which it is closer [14]. It courses posterolateral to the ampullary ends at the lateral and superior semicircular canals and at this point, the nerve forms a 130° angle with the IAC. It also rests on the anterior part of the vestibule in this segment [1, 15]. Tympanic air cells are also present in the wall of the facial canal in this segment [15].

The labyrinthine segment represents a narrow part of the facial canal, with no identifiable sheath. The facial nerve almost fills the space, and is surrounded by small blood vessels with a high susceptibility to compression, e.g., by edema. This is the only segment of the facial nerve that lacks an anastomosing arterial cascade, making the area vulnerable to embolic phenomena, low-flow states, and vascular compression [14, 15].

Tympanic segment

The second part of the fallopian canal and the fourth segment of the facial nerve, the tympanic segment, has a mean length of 10 mm (Fig. 3). It begins as the nerve moves past the geniculate ganglion posteriorly and laterally. This turn in the nerve is also known as the first genu [1, 16], which is located 2 mm from the ampullary end of the lateral semicircular canal [17]. The intersection of the labyrinthine and tympanic segment meets at an acute angle [18]. The tympanic segment lies between the labyrinth medially, and the tympanic cavity laterally. It can be further divided into proximal and distal parts, with almost equal lengths. The proximal tympanic segment extends from the geniculate ganglion to the posterior edge of the cochleariform process whereas the distal tympanic segment of the facial nerve extends from the posterior edge of the cochleariform process, to the posterior wall of the tympanum, at the level of the pyramidal eminence, which is a hollow bony prominence on the posterior wall of the middle ear that contains the stapedius muscle, where it enters the bony mass of the styloid complex [19]. In one study, the tympanic segment was found to lie slightly above and medial to the cochleariform process in 68 % of specimens and was adjacent to it in 32 %. The mean distance between the two structures was 2 mm [20].

The first part of the tympanic segment lies immediately above the end of the tensor tympani canal. Then, more posteriorly, the middle, nonprotruding part of the facial canal usually runs over the oval window in the medial wall of the tympanic cavity [14] with a mean distance of 3 mm from it [17], however in certain conditions it may run lower, through the oval window, close to the footplate of the stapes. It is limited by the lateral semicircular canal superiorly, which is always covered with cortical bone [14]. Occasionally, however, the facial nerve may be found projecting laterally above the level of the canal [21]. In another study, the tympanic segment was found to have an oblique course where it inclines inferiorly in 80 % of the specimens, and in the remaining 20 %, it was horizontal and parallel to the lateral semicircular canal [20]. As it runs posteriorly, the facial canal lies in close proximity to the pyramidal eminence before forming the second genu.

Sometimes, the facial canal may traverse the sinus tympani or contribute to its external wall [17]. The sinus tympani is a depression that is located on the border between the posterior and medial wall of the tympanic cavity, between the oval and round windows. In most cases, it has an oval shape, with a higher length vertically, and mean dimensions of 2.73 mm in

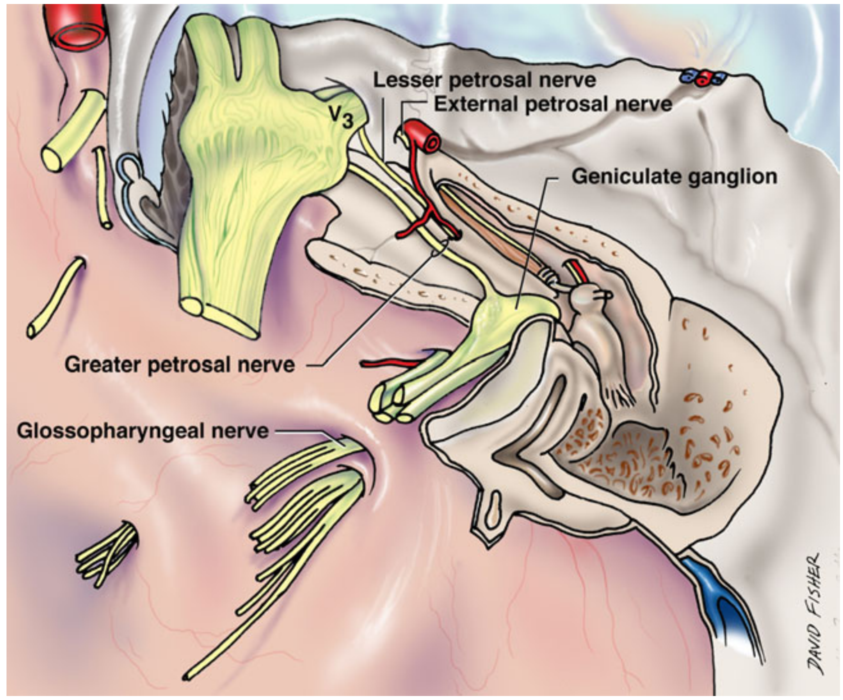

Fig. 2 Illustration of the geniculate ganglion and greater superficial pretrosal nerve with surrounding structures

length, 2.23 mm in width, and up to 10 mm in depth. The sinus is bounded medially by the posterior semicircular canal from which it is separated by a thin plate of bone. Laterally, it is bounded by the facial canal and the pyramidal eminence. The latter also forms its posterior boundary. Superiorly, it is bounded by the promontory bridge. Anteroinferiorly, it is separated from the round window by the subiculum of the promontory [22]. Dehiscence of the canal is more common at this segment. It can leave the nerve exposed in the tympanic cavity placing it at risk of injury during middle ear procedures [23, 24].

Mastoid segment

As the tympanic segment of the nerve ends, there is another sudden change of direction. Here, it turns between 90° and 125° from its posterolateral course to descend through the temporal bone [1]. This shift to a vertical course marks the second genu of the facial nerve and marks the beginning of the mastoid segment, the longest intratemporal section of the nerve with a mean length of 15 mm [20]. The second genu lies 21.6 mm from the outer cortex and 2 mm from the ampullary (posterior [21]) end of the horizontal semicircular

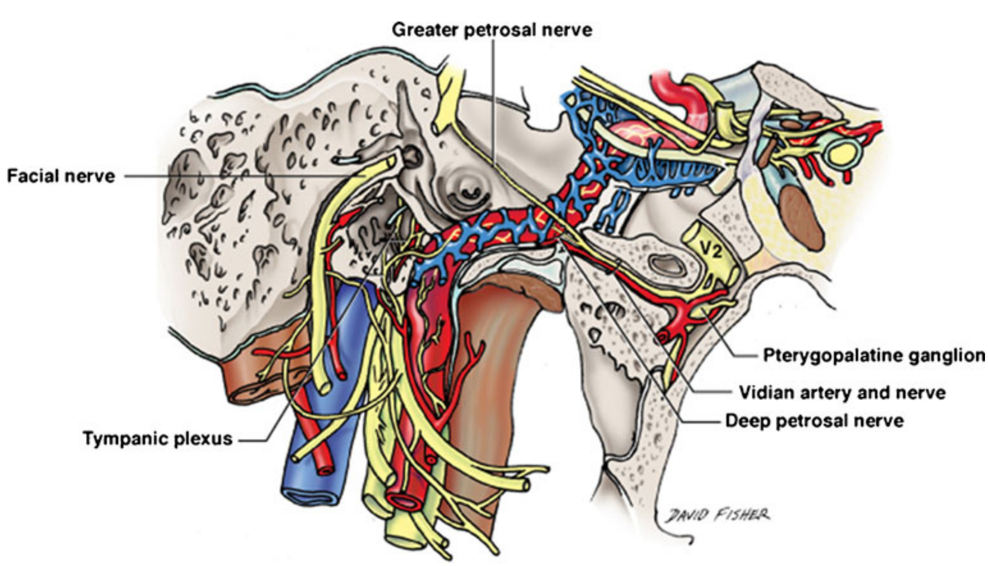

Fig. 3 Illustration of the typanic segment of the facial nerve in relationship to other neurovascular structures of the temporal bone

canal, and lateral and posterior to the pyramidal eminence. Variations in the course of the second genu include a postero-lateral bulge below the lateral semicircular canal in 20 %, and in 12 %, it was lateral to the prominence of the lateral semicircular canal [20]. The mastoid segment lies lateral and posterior to the pyramidal eminence. At this level, the facial canal turns vertically and continues down the anterior wall of the mastoid process to the stylomastoid foramen [17]. On its way down, the facial canal is related laterally to the horizontal semicircular canal, and medially to the jugular bulb, to which it lies 8 mm outside, or may adhere to it [25]. It also relates medially to the stapedius muscle [20]. Posteriorly, it is separated from the posterior fossa by a 4–11-mm space, occupied by retrofacial mastoid cells [25]. The mastoid segment emerges from the middle ear between the posterior wall of the external auditory canal and the lateral semicircular canal [17].

The sigmoid sinus (SS) is an important landmark for identifying the location of the mastoid segment. It is located 5.65 and 5.30 mm anteromedially to the SS, depending on the location of the portion studied. Another important landmark is the digastric ridge. This ridge points to the inferolateral part of the mastoid segment. It can be identified as the medial aspect of the mastoid tip in a well-pneumatized temporal bone. Also, line drawn along the posterior external auditory wall between the lateral semicircular canal and the digastric ridge provides the approximate course of this segment [25]. The mean distance between the ridge and the facial nerve is 3.8 mm [20]. The mean distance between the sigmoid sinus and the digastric ridge is 5 mm. The mean depth of the upper part of the mastoid segment is 12 mm, while at the lower part at the level of stylomastoid foramen is 10 mm. The distance between the mastoid tip and the stylomastoid foramen is 15 mm. All these measurements have certain variability between specimens, and between right and left sides in the same specimen [26]. The relation between the facial nerve and the tympanic annulus has received little attention in the literature [17, 27, 28]. The tympanic annulus is a shallow groove in the tympanic bone to which the thickened circumferential rim of the pars tensa of the tympanic membrane is attached. It has a horseshoe-like shape with a small part absent at the notch of Rivinus, the site of attachment of the pars flaccida, above both sides of the neck of the malleus [29]. In a study by Adad et al., in 1999, they found that the facial nerve coursed lateral to the plane of the annulus in 70 % of specimens, always in the postero-inferior quadrant. The nerve also coursed anterior to a plane through the most posterior point of the annulus in 73.1 % of specimens and exclusively in the posteroinferior quadrant. The distance, as is the course of the facial nerve, was highly variable between different points of the annulus, and within the same points between different specimens [28]. This variability, although considered reliable by some authors [25], makes this landmark unreliable in identifying the vertical part of the facial nerve [28]. The course of the mastoid segment was also variable, as 60 % of specimens examined show a vertical descent to the stylomastoid foramen and in 20 %, the nerve descends slightly laterally or medially [20]. In a study by Lindeman [30], variation in the size and form of the facial canal was found not only between individuals but also between different parts on the same individual.

There are two significant branches of the mastoid segment. The first one is the nerve to the stapedius muscle and the second is the chorda tympani nerve. After crossing the tympanic cavity, the chorda tympani exits the temporal bone through the petrotympanic fissure, and joins the lingual nerve to convey taste from the anterior two thirds of the tongue and parasympathetic input to the submandibular and sublingual gland [31].

Blood supply

The blood vessels surrounding the facial nerve within its narrow canal may be compromised by direct compression (e.g., facial nerve swelling), and lead to ischemia [15, 21]. The first of the two main arteries that supply the facial nerve within the canal is the stylomastoid artery, which arises from the posterior auricular or the occipital arteries. The second is the petrosal branch of the middle meningeal artery [15, 32]. The stylomastoid artery enters the facial canal through the stylomastoid foramen on the medial side of the nerve. At the lower part of the canal, the stylomastoid artery forms a loop, and leaves the canal with the posterior auricular branch. At the convexity of the loop, it gives rise to two branches. The shorter branch gives rise to smaller branches that leave the canal by piercing the posterior meatal wall in company with filaments from the auricular branch of the vagus nerve. The longer branch accompanies the facial nerve on its medial wall, up to the junction between the tympanic and mastoid segments in the second genu. It then turns around to reach the inferomedial aspect of the tympanic segment. At this point, it anastomoses directly with the petrosal artery to form a complete arterial arcade in the facial canal [32].

After entering the facial canal, the petrosal artery provides small branches to the geniculate ganglion, and continues along the tympanic segment of the facial nerve until it anastomoses with the stylomastoid artery. From the anastomotic arcade, branches are given at the site of the second genu and the origin of the chorda tympani. From there, a separate branch accompanies the chorda tympani, one or two branches run through the posterior wall of the canal to supply the mastoid air cells, and a branch leaves the facial canal and ramifies in the roof of the middle ear cavity [32].

Before reaching the geniculate ganglion, the facial nerve is widely separated from the periosteum of the meatal walls and its veins drain into branches of the internal auditory vein. Distal to the ganglion, the facial nerve becomes invested by a tight connective tissue sheath, which attaches to the periosteum on one hand and the epineurium of the nerve on the other. This sheath contains the blood vessels supplying and draining of the facial nerve. This sheath becomes thicker and denser as we approach the stylomastoid foramen and disappears thereafter. It fuses with the carotid sheath on the medial side, and behind, with the dense connective tissue deep to the mastoid process. The venous plexus here drains, anteriorly, into veins accompanying the petrosal artery and, inferiorly, into the veins accompanying the stylomastoid artery. An intrinsic vascular network of capillaries and venules are seen in the interfascicular connective tissue of the facial nerve [32]. Along the course of the facial nerve, the vascular network communicates with the blood vessels of marrow of the surrounding canal, as well as those of the mucous membranes of the tympanic cavity. When they leave the canal, these arteries spread along the labyrinthine part of the middle ear, where they communicate with the anterior and superior tympanic branches of the maxillary artery, the posterior tympanic branch of the posterior auricular artery, and the inferior tympanic branch of the ascending pharyngeal artery. It also reaches the tympanic membrane by way of the ear ossicles [15].

Extracranial segment

At the stylomastoid foramen, the facial nerve leaves the temporal bone, which marks the extracranial or sixth segment of the nerve. At this point, the fallopian canal has ended. In this foramen, the nerve is bounded medially by the styloid process and laterally by the mastoid tip. After leaving the foramen, the nerve courses anteriorly in an oblique caudal-external direction with a slight upward concavity. Before its bifurcation within the parotid gland, the facial nerve gives rise to a number of branches. Two of these branches are almost constant; the posterior auricular nerve, which supplies the superior and posterior auricular muscles, and the nerve to the digastric muscle, which supplies the posterior belly of this muscle. Another two non-consistent branches which are the ansa of von Haller, a communicating branch with the glossopharyngeal nerve and a branch to the stylohyoid muscle [33]. At the edge of the parotid gland, the facial nerve gives rise to an average of 12 branches. However, in certain conditions, the bifurcation does not occur within the parotid canal but proximal to it. These branches contribute to the five major segments of the extracranial part of the facial nerve, namely, from above to below: the temporal, zygomatic, buccal, mandibular, and cervical segments. The bifurcation of the nerve may have the shape of a "Y" with asymmetric arms (termed the pes anserinus or goose's foot).[30,44].

Anatomical malformations

The most significant anatomical aspect of the fallopian canal is the high incidence of dehiscence. It is unclear as to whether the dehiscences are anatomical variations or a sign of malformation [34]. In a study performed by Baxter [35], the foundation for understanding these variations was discussed. These dehiscences have been defined as gaps in the wall of the fallopian canal that were greater than 0.4 mm. Baxter found dehiscences in 55 % of temporal bones [35]. Several studies have found dehiscences in over 50 % of temporal bones, which only emphasizes the importance of studying this phenomenon of the canal before surgical procedures in the area [36, 37]. The most common site for dehiscence is the tympanic site close to the oval window [34, 38].

Embryology

Studies have been performed to observe the development of the fallopian canal in the fetus and its implications in the presence of dehiscence in the adult. Declau et al. divided this fetal development into three stages: before 16 weeks, between 16 and 21 weeks, 22–25 weeks.

In the first stage (preceding the 16th week of gestation), the otic capsule is cartilaginous, and the surrounding perichondrium splits around and contains the facial nerve. The facial nerve is related to a sulcus in the otic capsule on one side and to a thin connective tissue-like frame of condensed mesenchyme on the other. Once the nerve enters the labyrinthine segment and to the geniculate ganglion, it is completely dehiscent along its thin surface toward the middle cranial fossa. Following the ganglion, the cochlear part of the tympanic segment lies within the middle fossa and is completely dehiscent towards the brain. It then enters the middle ear through the hiatus of the facial canal. Along its vestibular course, the tympanic segment lies in a shallow groove and is dehiscent towards the middle ear cavity. The facial sulcus progressively increases in size. In the region of the stapedius muscle, the facial sulcus broadens, giving space for the anlagen of the facial recess laterally and the sinus tympani medially.

Between 16 and 21 weeks of gestation, ossification of the otic capsule starts at multiple endochondral ossification centers. According to Barnes et al. [38], by 20 weeks, ossification of the facial sulcus occurs by development of an osseous clasp that partially replaces the primitive fibrous covering of the membrane bone. Two weeks later, the superior clasp is ossified, while the inferior one is still incomplete. At 24 weeks, the superior and inferior clasps fuse resulting in the nerve being completely surrounded. A dehiscence is present between the two clasps. The long superior clasp covers most of the facial nerve. The shorter, inferior clasp is home to a larger dehiscence and a thinner layer of tissue surrounding it. Ossification is incomplete at the time of birth and continues through the formative years. Incomplete ossification results in dehiscence in adults. This condition heightens the risk for damage from surgical trauma. One explanation for incomplete ossification is a middle ear infection during infancy causing damage to these embryonic structures [38, 39].

Pathology

Fallopian canal pathology can be intrinsic or secondary to pathology of otic structures. A common endpoint is the development of facial nerve paralysis. Congenital malformations such as agenesis of the canal will result in complete facial paralysis. The canal can also be narrower than usual and aplastic: this can cause sporadic facial paralysis [34]. An acquired condition that results in intermittent facial paralysis from osseous overgrowth of the Fallopian canal is osteopetrosis [40]. Bell's palsy is the most common cause for facial paralysis and is responsible for approximately 50 % of facial nerve palsies. The cause is thought to be the activation of a dormant herpes virus [1]. Meningiomas can occur in the intratemporal segment of the facial nerve. Although meningiomas are common brain tumors, fallopian canal meningiomas are rare. Complete excision is curative [41].

Cerebrospinal fluid (CSF) can leak into the fallopian canal and result in CSF otorrhea. The cause for this condition can be congenital, traumatic, or iatrogenic. Congenital leaks can be found during myringotomy, tympanocentesis, or tube insertion for chronic middle ear effusion [42].

Surgical significance

The fallopian canal is encountered through several surgical approaches. Below, we give a perspective of the historical development of each approach and the special relationships and topography of the fallopian canal during each approach.

Translabyrinthine (TL) approach

The first known usage of the TL approach can be traced back to Panse [43] in 1904. However, with the lack of proper instrumentation at that time, the technique was abandoned. Almost 60 years later, using microsurgical equipment, House [44] initiated a more advanced form of the classical method in 1963, and applied this approach to surgeries on the seventh and eighth cranial nerves [45, 46]. His approach defined the classical TL approach. Over the following years, this approach underwent different modifications, which allowed for better exposure and removal of larger masses [45]. During the labyrinthectomy, the facial canal can be identified and skeletonized from the second genu near the lateral semicircular canal to the stylomastoid foramen and digastric ridge, which constitutes the mastoid segment of the fallopian canal. Following this, identification of the facial nerve is made proximally towards the fundus of the internal auditory canal, before entering the fallopian canal, where it is separated from the superior vestibular nerve by Bill's bar [47]. Other surgeons use more risky methods of identifying the facial nerve by exposing the labyrinthine part, at the meatal segment, or identifying the facial nerve by displacing the tumor capsule inferiorly [11]. In Pulec's description of the approach, he mentioned skeletonizing and tracing the facial nerve from the cochleariform process to the IAC [46]. An alternative method proclaimed by Sanna et al. involved exposure of the facial nerve at the level of its mastoid segment. Next, these authors identified the superior ampullary nerve at the fundus

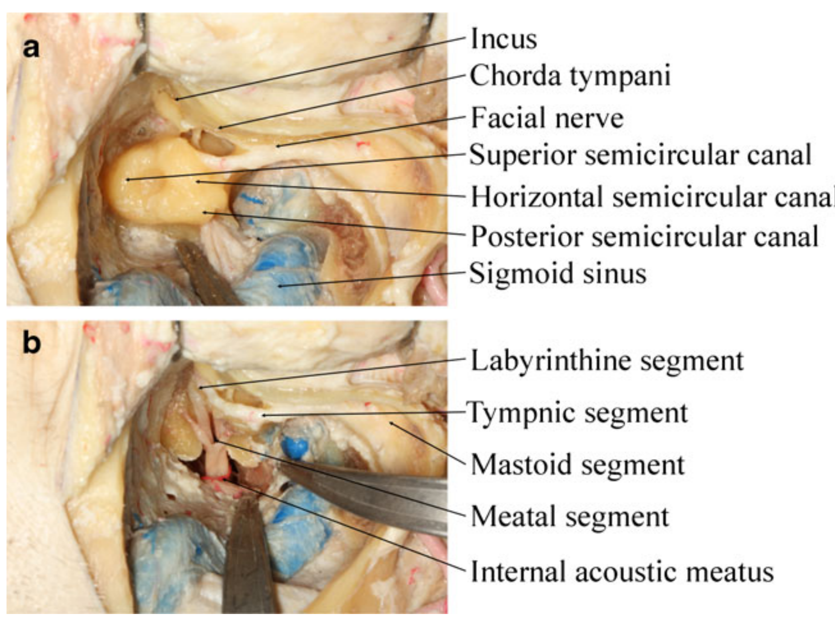

Fig. 4 **a** Cadaveric dissection (lateral view) of the labyrith and facial canal. **b** Cadaveric dissection (lateral view) of the internal acoustic meatus showing all segments of the fallopian canal according to the proposed classification

of the IAC, which is then medially reflected and the facial nerve is identified were it leaves the IAC [11].

Transcochlear (TC) approach

The first description of the TC approach was done by House and Hitselberger [48, 49] in the mid-seventies. They developed this approach as an anterior extension of the TL approach. Following the mastoidectomy, the facial canal and nerve can be identified along its descending (mastoid) segment. Then, the bony labyrinth is drilled out and the IAC is exposed. At this point, the labyrinthine segment of the facial nerve is identified, and the facial nerve is skeletonized from the styloid process to the IAC. This is followed by cutting the greater petrosal nerve from its origin near the geniculate ganglion, and sectioning of the corda tympani nerve. The facial nerve is reflected posteriorly out of the canal to avoid traction or bending of the nerve, with care taken to avoid kinking of the nerve [49–51].

Retrosigmoid (RS) approach

According to the description of Ciric et al., facial nerve identification during the RS approach depends on the size of the tumor. For larger tumors (>1.5–2 cm), the tumor is decompressed first and then the IAC is drilled out to identify the meatal part of the facial nerve. For smaller ones, the IAC is opened and the facial nerve first identified [52].

Conclusions and proposal of a new anatomical classification

The fallopian canal is generally seen as the bony part of the facial nerve's pathway from its emergence at the brain stem to its exit at the stylomastoid foramen. Therefore, the fallopian canal has been equated to the facial canal. However, when we look at the classical and accepted description of the fallopian canal, it is said to begin with the labyrinthine segment and end at the stylomastoid foramen, which is the end of the mastoid segment. The facial nerve's second segment, also known as the meatal segment, which is the distance between the entrance of the facial nerve into the temporal bone through the internal auditory meatus, and the beginning of the labyrinthine segment, is therefore, classically, not included as part of the fallopian canal. We cannot answer the question why Gabrielle Fallopio did not include the meatal segment in his original description of the facial canal. However, from an anatomical and surgical perspective, it is logical to include the meatal segment in the facial canal. As Gabrielle Fallopio's significant contribution to this canal should not be forgotten, we suggest that the classical fallopian canal should be modified to include the meatal segement. This means that it begins at the internal auditory meatus and ends at the stylomastoid foramen and hence will have four segments: meatal, labyrinthine, tympanic, and mastoid (Fig. 4).

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