

## Landmarks for parotid gland surgery

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### Abstract

Many surgical landmarks have been suggested to help the surgeon identify the facial nerve when performing parotid gland surgery. There is no conclusive evidence that any one landmark is better than the rest. In this study distances from the most frequently used surgical landmarks to the main trunk of the facial nerve were measured in 30 halves of cadaver heads. Two ENT surgeons assessed the best landmark in each case. The tympanomastoid suture was nearest to the main trunk and was therefore considered the most reliable landmark. Its average distance to the main trunk of the facial nerve was 2.7 mm. This result was consistent with the subjective best score given by two ENT surgeons.

**Key words:** Parotid Gland; Surgical Procedures, Operative; Facial Nerve

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### Introduction

During parotid gland surgery the preservation of the facial nerve depends upon its exposure and on the surgeon being able to find it without damaging it. Avoiding trauma requires detailed knowledge of the anatomy and considerable care during the operation.<sup>1–3</sup> A surgeon has to be familiar with a range of techniques because variations in the pathology may make any given approach difficult. It would thus be very helpful to develop a precise and widely acceptable procedure that uses invariable anatomical landmarks to quickly identify the facial nerve.

Up to the 1940s, the retrograde technique was advocated.<sup>1,2,4,5</sup> The retrograde technique is time-consuming, especially when the tumour is large, when there has been distortion of the intraparotid facial nerve plexus by bulky infiltrating tumours, or when scarring has occurred due to previous procedures.<sup>1</sup> This technique has largely been abandoned because of these drawbacks.<sup>6</sup> It is still used for small tail of parotid tumours in which it has the advantage of allowing the patient to receive only a cervical mastoid incision and avoids unnecessary exposure of the main trunk and the upper branches.

The first surgeon to describe the exposure of the main trunk at its origin was Janes, in 1940.<sup>5</sup> Since that time, several surgical landmarks have been described. Various authors have advocated their use to facilitate the identification of the facial nerve trunk.<sup>2</sup>

The upper border of the posterior belly of the digastric muscle and its attachment to the mastoid process has frequently been used to identify the trunk of the facial nerve.<sup>1,2,7</sup> The nerve is found approximately 1.5 cm antero-cranial to this point. Holt found the nerve at the stylomastoid foramen, about 9 mm from the digastric muscle in 20 specimens.<sup>8</sup>

Also the pointer, a portion of the tragal cartilage which points in the direction of the nerve, is used as a landmark. The nerve lies one to 2 cm deeper than the pointer.<sup>2,7</sup> On computed tomography (CT) and magnetic resonance (MR) images, the main trunk lies 10 to 15 mm caudal to the pointer.<sup>9</sup>

Bone structures are more suitable as anatomical guides because of their rigid and reliable anatomical location.<sup>10</sup> Brintnall *et al.* found the main trunk of the nerve between two bony landmarks.<sup>11</sup> Superiorly, it lay near the sharp, fingernail-like bony ridge at the anteroinferior margin of the external auditory meatus of the skull. Inferiorly, it was found near the broad blunt anterior margin of the mastoid process of the temporal bone. There is a V-shaped sulcus between these two bony landmarks. The main trunk of the nerve is found close to this sulcus; it cannot be more than 2 to 3 mm from the depth of the dissection. This is one of the first references to the fissura tympanomastoidea (tympanomastoid suture).

Behrs, and Heeneman describe the same sort of technique.<sup>5,12</sup> One index finger is placed flush with the lowermost tip of the mastoid process on top of,

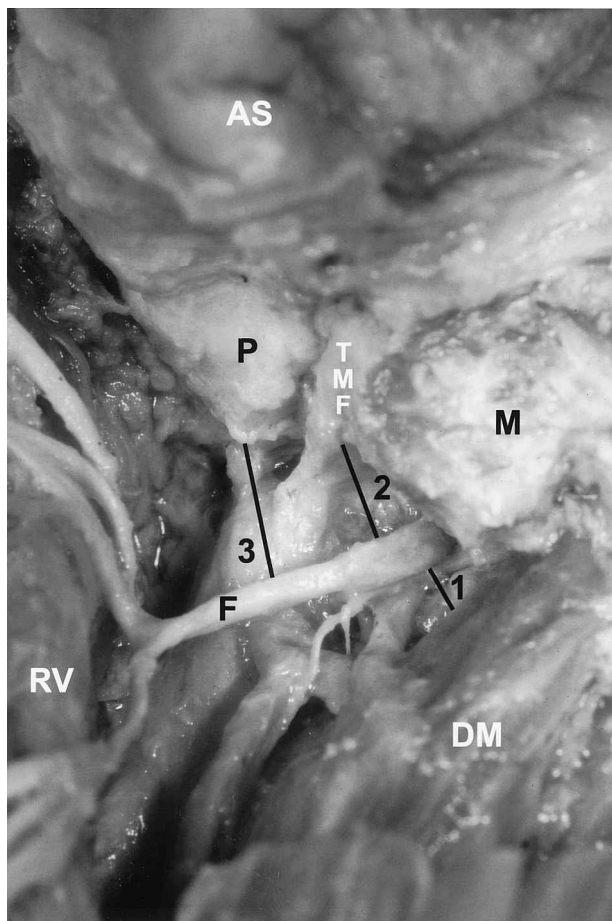


FIG. 1

Dissected facial nerve; left side; (infero)-lateral view. AS= auricula sinistra; F= facial nerve; DM = diagastric muscle; TMF= tympanomastoid fissure; RV= retromandibular vein; P= 'pointer'; M = mastoid process; 1 = shortest distance from the digastric muscle to the main trunk of the facial nerve; 2 = shortest distance from the tympanomastoid fissure to the main trunk of the facial nerve; and 3 = shortest distance from the 'pointer' to the main trunk of the facial nerve.

and parallel to, the fibres of the sternocleidomastoid muscle. The other index finger is placed on the lateral surface at an angle of 90 degrees with the first finger, and in doing so, it points directly forward. The trunk of the facial nerve will be found to be deep and slightly anterior to the centre of the fingertip so placed.

The styloid process was also used as a landmark. This, however, is not considered to be reliable because it lies too deep, so when the surgeon reaches the styloid process, the nerve has already been passed.<sup>7,12,13</sup> Furthermore, the styloid process is absent in 30 per cent of the cases.<sup>14</sup>

TABLE I

MEAN SHORTEST DISTANCE IN MM FROM A THE 'POINTER', B THE DIGASTRIC MUSCLE, AND C THE TYMPANOMASTOID SUTURE TO THE MAIN TRUNK OF THE FACIAL NERVE (MEASUREMENTS BY TWO OBSERVERS; 30 HALVES OF CADAVER HEADS)

Mean shortest distance to facial nerve (SD)			
Observer 1	A 8.4 (3.6) n = 30	B 4.8 (2.27) n = 29	C 2.7 (.7) n = 29
Observer 2	A 7.3 (2.4) n = 28	B 4.5 (2.34) n = 29	C 2.6 (.8) n = 29

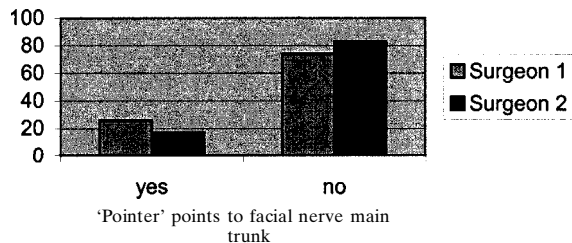


FIG. 2

Percentage of cases in which the 'pointer' points to the facial nerve main trunk.

This anatomical study is an attempt to determine, as objectively as possible, which of the landmarks described in the literature is the best.

**Materials and methods**

Thirty facial nerves were dissected in formaldehyde-fixed cadavers. A pre-auricular incision was made. Following the tragal cartilage, we dissected until the level of the digastric muscle. Then the facial nerve was identified, and a superficial parotidectomy was performed. Next, the sternocleidomastoid muscle was detached from the mastoid process (Figure 1). Finally, the shortest distances from the main trunk (i.e. from the commencement at the foramen stylomastoideum to the first bifurcation into upper and lower branches) of the facial nerve to the posterior belly of the digastric muscle, to the pointer, and to the tympanomastoid suture were measured. Two observers, anatomists, made the measurements. Pearson's correlation was used to determine whether there was agreement between the observers. After this procedure, two ENT surgeons independently chose the landmark that seemed best in each case. Their option were a) the pointer, b) the tympanomastoid suture, c) the posterior belly of the digastric muscle, and in addition to these landmarks, d) the fingertip method described by Heeneman. These options were ranked from 1 to 4 in each cervico-facial half by both surgeons. Then the pointer was judged as pointing to the nerve or not. The Friedman test was used to determine whether there was a significant difference between the preferences for the landmarks. Finally, we examined the relationship between the objective measurements and the subjective scoring.

TABLE II

BOUNDARIES OF THE SHORTEST DISTANCE IN MM FROM THE POINTER TO THE FACIAL NERVE OF THE CASES IN WHICH THE POINTER WAS THE PREFERRED LANDMARK AND FOR THE CASES IN WHICH IT WAS NOT THE PREFERRED LANDMARK; (95 PER CENT INTERVAL; MEASUREMENTS BY TWO OBSERVERS)

	Observer 1	Observer 2
Lower boundary if pointer was landmark of preference	3.7	2.6
Lower boundary if pointer was not landmark of preference	7.2	6.2
Upper boundary if pointer was landmark of preference	9.7	10.1
Upper boundary if pointer was not landmark of preference	11.2	8.7

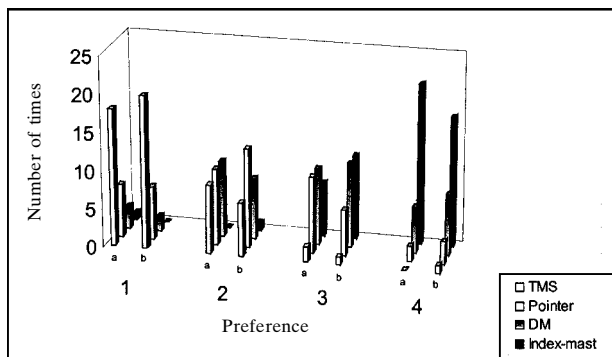


FIG. 3

Subjective ranking on a scale of 1 (best) to 4 for four different landmarks. 1 = tympanomastoid suture; 2 = 'pointer' (tragal cartilage); 3 = digastric muscle; 4 = one index finger at the lowermost tip of the mastoid and the other at a straight angle at the lateral surface pointing straight forward to the nerve. Ranking by two ENT surgeons (a and b).

## Results

The results of the measurements were as follows. The mean distance from the pointer to the main trunk of the facial nerve was 8 mm (see Table I). The average shortest distance from the digastric muscle to the main trunk of the facial nerve was 4.5 mm (see Table I). The tympanomastoid suture had an average shortest distance to the nerve of 2.7 mm (see Table I). The 'pointer' pointed to the facial nerve main trunk in 20 per cent of the cases (Figure 2). If the pointer was the preferred landmark, its distance to the nerve was found in a range from 3.2 to 9.9 mm. However, if it was not the preferred landmark, its distance to the nerve varied from 6.7 to 10 mm (see Table II). Furthermore, in only three of the cases, whereby the pointer was the landmark of preference, was it described as pointing to the nerve.

Agreement between the two anatomists was significant for all measurements mentioned above at the 0.01 level (two-tailed using Pearson's correlation index (correlation from 0.786 to 0.934). With regard to the preferences, there was considerable agreement between the surgeons (Figure 3). Furthermore, the difference between preference for the landmarks proved significant using the Friedman test (FR (x) 43.92) for surgeon 1 and (FR (x) 44.05) for surgeon 2 both  $p < 0.0005$ .

## Discussion

This study shows the tympanomastoid suture as the landmark nearest to the main trunk of the facial nerve. As mentioned by Robertson and Blake,<sup>6</sup> it was sometimes difficult to find the right drop-off point of the suture. However, in our dissections, the nerve had been found already, which made the problem less difficult. Also, each of the ENT surgeons found the tympanomastoid suture to be the most useful landmark. In our clinic, the pointer was regarded as the most useful indicator and, until very recently, was therefore used in surgery. Although the difference is not significant, there is a

tendency to refer to the pointer as the best landmark when it simply has a very short distance to it (see Table III). The outcome of the mean distances for every single landmark is alike for the two observers, except with respect to the pointer (see Table I). This suggests that the definition and direction of the pointer are not always interpreted in the same way by each of the observers. This is in agreement with Robertson and Blake who found it difficult to decide where the cartilage points, because it is mobile, asymmetrical and has a blunt irregular tip.<sup>6</sup> Furthermore, the means and standard deviations for the distances from the posterior belly of the digastric muscle and from the pointer to the facial nerve show a relatively great variation. The range is probably due to anatomical variability. This strengthens the conclusion that these structures are not the best landmarks. Differences between our results concerning the distances and the results of other authors might be due to fixation artefacts. But, we think that the post-mortem artefacts would probably influence the absolute distances more than the relative distances. The artefacts might alter (shorten) the distance, but there is no conclusive evidence that it would change one distance more than the other.

Based on these results, the following method of surgery has been introduced recently in our clinic. The incision is pre-auricular. The cartilage of the pointer is followed medially. After the pointer has been dissected, a microscope is used for further dissection. Next, the tympanomastoid suture is identified. According to some authors, this structure is the most reliable landmark.<sup>6,10,15</sup> It is (1) easy to find, (2) its position is invariable (3) its relation to the nerve is reliable because it leads to the stylomastoid foramen, and (4) it allows the nerve to be identified close to the foramen where it is least subject to displacement. According to the results of our study, the nerve is found within 3 mm of this landmark. We find this a very practical method.

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