Anatomical study of the trigeminal and facial cranial nerves with the aid of 3.0-tesla magnetic resonance imaging

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Object. Neuroimages often reveal that the trigeminal or facial nerve comes in contact with vessels but does not produce symptoms of trigeminal neuralgia (TN) or hemifacial spasm (HFS). The authors conducted this study to determine how often the trigeminal and facial nerves came in contact with vessels in individuals not suffering from TN or HFS. They also investigated the correlation between aging and the anatomical measurements of the trigeminal and facial nerves.

Methods. Between November 2005 and August 2006, 220 nerves in 110 individuals (60 women and 50 men; mean age 55.1 years, range 19–85 years) who had undergone brain magnetic resonance (MR) imaging for other reasons were studied. The lengths, angles, ratio, and contact points were measured in each individual. A correlation between each parameter and age was statistically analyzed.

Results. The mean (± standard deviation) length of the trigeminal nerve was 9.66 ± 1.71 mm, the mean distance between the bilateral trigeminal nerves was 31.97 ± 1.82 mm, and the mean angle between the trigeminal nerve and the midline was 9.71 ± 5.83°. The trigeminal nerve was significantly longer in older patients. Of 220 trigeminal nerves, 108 (49.0%; 51 women and 57 men) came in contact with vasculature. There were 1 contact point in 99 nerves (45%) and 2 contact points in 9 nerves (4.1%). Contact without deviation of the nerve was seen in 91 individuals (43 women and 48 men), and mild deviation was noted in 17 individuals (8 women and 9 men). There was no moderate or severe deviation in any individual in this series. The mean length of the facial nerve was 29.78 ± 2.31 mm, the mean distance between the bilateral facial nerves was 28.65 ± 2.22 mm, the angle between the nerve and midline was 69.68 ± 5.84°, and the vertical ratio at the porus acusticus was 0.467 ± 0.169. Of all facial nerves, 173 (78.6%; 101 in women and 72 in men) came in contact with some vasculature. Contact without deviation was seen on 64 sides (in 37 women and 27 men), mild deviation on 98 sides (in 57 women and 41 men), and moderate deviation on 11 sides (in 7 women and 4 men). There was no severe deviation of the facial nerve in this series. The proximal length of the facial nerve, interval, angle, and ratio against the age were significantly shorter or smaller in the older individuals.

Conclusions. The findings in asymptomatic individuals in this study will help in deciding which findings observed on MR images may cause symptoms. In addition, the authors describe the variations of normal anatomy in older individuals. Knowledge of the normal anatomy helps to hone the diagnostic practices for microvascular decompression, which may increase the feasible results on such surgery. (DOI: 10.3171/JNS/2008/108/3/0483)

Key WORDS • anatomical study • facial nerve • magnetic resonance imaging • trigeminal nerve

With the recent advances in modern neuroimaging, vessels causing TN or HFS can be detected in patients. However, we frequently view neuroimages in which the trigeminal or facial nerve comes in contact with vessels but does not produce symptoms of TN or HFS in clinical cases. Klun and Prestor17 found that 42 (32.3%) of 130 normal cadaveric specimens had neurovascular contact on the trigeminal TZ, or Obersteiner–Redlich zone, and 10 (7.7%) of 130 had compression; the zone is defined as the margin where both central nervous system and peripheral nervous system tissue are contained. Matsushima et al.21 stated that 24 (68.6%) of 35 facial nerves in cadaveric specimens came in contact with arteries, although it was not mentioned if HFS existed.

There are no data on the exact normal anatomy of the trigeminal and facial nerves in a living body. Therefore, we conducted this study to determine how often the trigeminal and facial nerves come in contact with vessels in individuals not suffering from TN or HFS. We also investigated the correlation between aging and anatomical measurements of the trigeminal and facial nerves by using 3.0-T MR imag-
Clinical Material and Methods

The study was approved by the ethical committee in Seguchi Neurosurgical Hospital. One hundred ten healthy individuals (60 women and 50 men) were included in this study. These individuals had undergone brain MR imaging examination for other reasons. The mean age at the time of MR imaging was 55.1 ± 13.6 years (± standard deviation) (range 19–85 years). In total, 220 trigeminal and facial nerves were investigated.

Between November 2005 and August 2006 all MR imaging studies were performed using a 3.0-T MR imaging system (Signa Excite 3.0 T, GE Healthcare Japan Branch) at Seguchi Neurosurgical Hospital. The FIESTA axial sequencing of the entire brain was performed with the following parameters: TR 5.5 msec, TE 2.5 msec, slice thickness 0.5 mm with no gap, matrix size 224 × 224, field of view 18 cm, slice thickness 0.5 mm with no gap, number of excitations 1, and bandwidth 31.25. Time-of-flight spoiled gradient recalled acquisition in the steady state, 3D MR angiography was performed in the axial plane by using the following parameters: TR 25 msec, TE 3.3 msec, flip angle 20°, matrix size 512 × 224, field of view 18 cm, slice thickness 0.5 mm with no gap, number of excitations 1.0, and bandwidth 31.25.

The Digital Imaging and Communications in Medicine (DICOM) MR images were imported to the workstation for MPR parallel to the trigeminal nerve and facial nerve (we refer to them as the oblique sagittal and oblique coronal planes, respectively) in each individual. Another MPR plane parallel to the long axis of the bilateral nerves (oblique axial) was used. The FIESTA MPR images were used to evaluate the neurovascular contact in each individual. The MPR images created from MR angiograms were used to determine whether the vessels were arteries.

Measurement of the Trigeminal Nerve

The length of the cisternal segment of the trigeminal nerve (from the REZ to the narrowest aperture of the Meckel cave) in the oblique sagittal plane, the interval of the bilateral nerves (distance between bilateral medial surfaces of the trigeminal nerve at the point where the nerve emerged from the pons), and the angle between the midline and the long axis of the trigeminal nerve both in the oblique axial planes were all measured (Fig. 1 upper left and right).

Measurement of the Facial Nerve

Length 1 of the facial nerve was defined as the curved length between the superior margin of the supraorbital fossa and the root exit zone in which the facial nerve separated from the pons. Length 2 was defined as the total length of the cisternal and meatal segment of the facial nerve (the distance between the root exit zone and the point where the facial nerve entered the facial canal in the internal auditory canal). The entire length was defined as the sum of Length 1 and Length 2 in the oblique coronal plane. We also measured the interval of bilateral facial nerves (distance between bilateral medial aspects of facial nerves), the angle between the midline and the long axis of the seventh nerve in the oblique axial plane, and the vertical ratio at the narrowest space near the porus acusticus (we defined the ratio calculated using the following equation: upper surface of the internal acoustic canal to the facial nerve/the distance from the lower surface of the internal acoustic canal to the facial nerve in the oblique coronal plane [Fig. 1 lower left and right]).

Statistical analysis was performed using JMP software (JMP 6.0, SAS Institute).

To ascertain the nature of cranial nerves in older patients, we analyzed the correlation between the age of individuals and each measured result of the parameters described earlier. The results were compared between women and men by using an unpaired t-test.

Nerve distortion or deviation was also evaluated. No deviation of the long axis of the nerve but with some contact with the vessels was defined as “contact.” Deviation vertical to the long axis of the nerve within the thickness of its nerve was classified as “mild deviation.” Deviation beyond the thickness of its nerve was defined as “moderate deviation.” Deviation causing brainstem rotation by vessels was deemed “severe deviation.”

Results

The Trigeminal Nerve

Measurement. The mean length of the trigeminal nerve was 9.66 ± 1.71 mm (range 5.53–14.1 mm; 9.15 ± 1.52 mm in women and 10.27 ± 1.57 mm in men [significant difference between sexes, p < 0.0001]). The mean distance between the medial surfaces of the bilateral trigeminal nerves was 31.97 ± 1.82 mm (range 28.03–36.43 mm; 31.60 ± 2.14 mm in women and 32.41 ± 2.72 mm in men [significant difference between sexes, p = 0.0195]). The mean angle between the trigeminal nerve and the midline was 9.71 ± 5.83° (range −3.41–33.07°; 9.65 ± 5.01° in women and 9.80 ± 6.24° in men) (Table 1).

Contact Point. Of all 220 trigeminal nerves, 108 (49.0%) came in contact with some vessels in 51 women and 57 men. There was 1 contact point on 99 sides (45%), and there were 2 contact points on 9 sides (4.1%). The nerves came in contact with arteries at 101 points and veins at 16 points. Locations of contact are illustrated in Fig. 2 upper. The degrees of deviation of the trigeminal nerve are shown in Table 2. Contact without deviation was seen on 91 sides (43 women and 48 men), and mild deviation on 17 sides (8 women and 9 men). No moderate or severe deviation was noted in any individual in this series.

Aging. There was no statistically significant correlation between age and the interval of bilateral trigeminal nerves and angle. However, there was a significant correlation between age and length of the trigeminal nerve. The trigeminal nerve was significantly longer in older individuals (Fig. 3 and Table 3).

The Facial Nerve

Measurement. The mean measurement of Length 1 of the facial nerve was 8.41 ± 1.12 mm (range 5.69–12.21 mm; 8.32 ± 1.00 mm in women and 8.53 ± 1.15 mm in men). The mean measurement of Length 2 was 21.37 ± 2.26 mm (range 15.91–28.28 mm; 20.88 ± 2.07 mm in women and 21.95 ± 2.11 mm in men [statistically significant difference
between sexes, \( p = 0.0004 \)). The mean entire length of both segments was 29.78 ± 2.31 mm (range 23.92–37.73 mm; 29.20 ± 2.02 mm in women and 30.48 ± 2.25 mm in men [statistically significant difference between sexes, \( p < 0.0001 \)]. The mean distance between the bilateral facial nerves was 28.65 ± 2.22 mm (range 21.6–33.97 mm; 28.38 ± 3.09 mm in women and 28.97 ± 2.79 mm in men). The mean angle between the nerve and the midline was 69.68 ± 5.84° (range 50.58–87.61°; 69.57 ± 5.39° in women and 69.81 ± 5.79° in men). The mean vertical ratio at the porus acusticus was 0.467 ± 0.169 (range 0–1; 0.48 ± 0.17 in women and 0.45 ± 0.15 in men) (Table 1).

Contact Point. Of all facial nerves 173 (78.6%) (101 in women and 72 in men) came in contact with some vessels or structures. There was 1 point on 121 sides (55%), 2 points on 40 sides (18.2%), and ≥ 3 points on 12 sides (5.4%). The structures coming in contact with the facial nerves were arteries (223 points), veins (7 points), the dura mater (5 points), and other cranial nerves (4 points). Figure 2 lower depicts the location of contact sites of all 173 sides. The degrees of deviation of the facial nerve are shown in Table 2. Contact without deviation was seen on 64 sides (37 women and 27 men), mild deviation on 98 sides (57 women and 41 men), and moderate deviation on 11 sides (7 women and 4 men). All the MR images of these 11 sides are shown in Fig. 4. There were no cases of severe deviation in any patient in this series.

Aging. A statistical correlation was observed in Length 1, trigeminal length (mm) 220 9.15 ± 1.52 10.27 ± 1.57 9.66 ± 1.71 (5.53–14.1) \(<0.0001^*\)
interval (mm) 110 31.60 ± 2.14 32.41 ± 2.72 31.97 ± 1.82 (28.03–36.43) 0.0195*
angle (°) 220 9.65 ± 5.01 9.80 ± 6.24 9.71 ± 5.83 (−3.41–33.07) 0.8492
facial Length 1 (mm) 220 8.32 ± 1.00 8.53 ± 1.15 8.41 ± 1.12 (5.69–12.21) 0.1683
Length 2 (mm) 220 20.88 ± 2.07 21.95 ± 2.11 21.37 ± 2.26 (15.91–28.28) 0.0004*
total length (mm) 220 29.20 ± 2.02 30.48 ± 2.25 29.78 ± 2.31 (23.92–37.73) \(<0.0001^*\)
interval (mm) 110 28.38 ± 3.09 28.97 ± 2.79 28.65 ± 2.22 (21.6–33.97) 0.1628
angle (°) 220 69.57 ± 5.39 69.81 ± 5.79 69.68 ± 5.84 (50.58–87.61) 0.757
ratio 220 0.48 ± 0.17 0.45 ± 0.15 0.467 ± 0.169 (0–1) 0.1744

* Statistically significant.

TABLE 1

Results of each measurement in women and men

<table>
<thead>
<tr>
<th>Nerve</th>
<th>No. of Nerves</th>
<th>Mean ± Standard Deviation</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women (120 nerves)</td>
<td>Men (100 nerves)</td>
<td>Overall (range)</td>
</tr>
<tr>
<td>trigeminal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>length (mm)</td>
<td>220</td>
<td>9.15 ± 1.52</td>
<td>10.27 ± 1.57</td>
</tr>
<tr>
<td>interval (mm)</td>
<td>110</td>
<td>31.60 ± 2.14</td>
<td>32.41 ± 2.72</td>
</tr>
<tr>
<td>angle (°)</td>
<td>220</td>
<td>9.65 ± 5.01</td>
<td>9.80 ± 6.24</td>
</tr>
<tr>
<td>facial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length 1 (mm)</td>
<td>220</td>
<td>8.32 ± 1.00</td>
<td>8.53 ± 1.15</td>
</tr>
<tr>
<td>Length 2 (mm)</td>
<td>220</td>
<td>20.88 ± 2.07</td>
<td>21.95 ± 2.11</td>
</tr>
<tr>
<td>total length (mm)</td>
<td>220</td>
<td>29.20 ± 2.02</td>
<td>30.48 ± 2.25</td>
</tr>
<tr>
<td>interval (mm)</td>
<td>110</td>
<td>28.38 ± 3.09</td>
<td>28.97 ± 2.79</td>
</tr>
<tr>
<td>angle (°)</td>
<td>220</td>
<td>69.57 ± 5.39</td>
<td>69.81 ± 5.79</td>
</tr>
<tr>
<td>ratio</td>
<td>220</td>
<td>0.48 ± 0.17</td>
<td>0.45 ± 0.15</td>
</tr>
</tbody>
</table>

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3.0-T MR imaging of trigeminal and facial nerves

![Fig. 1. Illustrations showing structures and measurements studied. Upper Left: Oblique sagittal view parallel to the trigeminal nerve. Upper Right: Oblique axial view parallel to the long axis of the trigeminal nerve. Lower Left: Oblique coronal view parallel to the facial nerve. Lower Right: Oblique axial view parallel to the facial nerve. a = the length of the trigeminal nerve; b = the interval between bilateral trigeminal nerves; c = the angle between the midline and long axis of trigeminal nerve; d = Length 1, defined as the distance from the superior margin of the supraolivary fossette to the root exit zone of the facial nerve along the lower surface of the pons; e = Length 2, defined as the length of the cisternal and meatal segments of the facial nerve; f = the interval between bilateral facial nerves; g = the angle between the midline and long axis of the facial nerve; h = the narrowest distance near the porus acusticus; i = the distance from the upper surface of the meatus to the middle point of the facial nerve on the line defined as h.](image-url)
the interval of bilateral facial nerves, angle, and orifice ratio against age. However, the correlation of Length 2, and the total length against age revealed no significant difference. Length 1 of the facial nerve, interval, angle, and ratio against the age were significantly shorter or smaller in older patients (Fig. 5 and Table 3).

Discussion

Regarding the TZ, transition between the central nervous system and the peripheral nervous system usually occurs a certain distance from the point at which nerve roots emerge from and enter the brainstem or the spinal cord. The REZ is distinctly different from the TZ by its definition. The TZ lies more peripherally in sensory than in motor nerves, but in both, the apex of the TZ is described as a glial dome whose convex surface is directed distally.

The Trigeminal Nerve

As described earlier, the TZ of the “sensory” trigeminal nerve is more distal than that of the facial nerve; it has been reported that the TZ of the trigeminal nerve is located 2–10 mm distally from the brainstem. Authors of previous clinical reports mentioned that MVD performed

![Graphs demonstrating the points of all objects in which the nerve contacts with vessels. Upper: Trigeminal nerve contacts. Lower: Facial nerve contacts. Vertical bars indicate the contact area, not the points, along the long axis of the nerves. The y axis shows the distances distally from the REZ or root exit zone.](image)

![Scatterplots showing the correlation between age and each parameter of the trigeminal nerve (V). The circles indicate the 95% density ellipse, the horizontal lines the average of the parameters, and the tilted lines the major axis of the ellipse.](image)
only at the TZ of the trigeminal nerve was sufficient.\textsuperscript{8,18,36} However, McLaughlin et al.\textsuperscript{22} described that the TZ of the trigeminal nerve as extending to a more distal portion of the nerve. Therefore, the nerve should be examined in all cisterns, and all vessels should be treated. Sindou et al.\textsuperscript{31} reported that the compression site was located at the middle part of the cisternal portion of the trigeminal nerve in 45\% of 579 cases, and near the Meckel cave in 10\%. On the other hand, no vessels compressing the trigeminal nerve were found in the operative field in 7.5\% of all 3256 cases in another report.\textsuperscript{9} After MVD, favorable results were attained in at most 70\% of cases.\textsuperscript{4,7,9} These results can be explained as indirect injury occurring at the TZ by severe nerve root traction at any cisternal segment\textsuperscript{3,31} or focal chronic demyelination due to ischemic changes at the TZ caused by long-standing TN.\textsuperscript{6,14,20,27} Other reasons for ineffective MVD may be due to other intracranial conditions such as multiple sclerosis.

In the present study, nearly half of all nerves came in contact with vessels at various portions in the cisternal segment; however, these contacts were not thought to cause the TN. Knowing that these findings were present in individuals who did not have symptoms is valuable for deciding which is the offending artery in patients. Anderson et al.\textsuperscript{2} have confirmed that nerves with more severe compression are more likely to be pathognomonic and that compression of the nerve is more likely to be associated with an artery than a vein. We speculate that symptoms do not occur when the trigeminal nerve barely touches the vessels and there is no deviation or deformation of the nerve. However, we must take care when the nerve is pinched by vessels on both sides; in this situation the nerve might not deviate.

**The Facial Nerve**

Ordinarily, the TZ of the facial nerve is reported to be 1–3 mm distal to the REZ.\textsuperscript{1,32} The TZ of the nerve was difficult to measure because the root of the nerve tangentially

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Trigeminal Nerve</th>
<th>Facial Nerve</th>
</tr>
</thead>
<tbody>
<tr>
<td>contact frequency</td>
<td>108/220 (49.0)</td>
<td>173/220 (78.6)</td>
</tr>
<tr>
<td>women</td>
<td>51/120 (42.5)</td>
<td>101/120 (84.2)</td>
</tr>
<tr>
<td>men</td>
<td>57/100 (57)</td>
<td>72/100 (72)</td>
</tr>
<tr>
<td>no. of contact points</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>99 (45)</td>
<td>121 (55)</td>
</tr>
<tr>
<td>2</td>
<td>9 (4.1)</td>
<td>40 (18.2)</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>10 (4.5)</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>2 (1)</td>
</tr>
<tr>
<td>severity of nerve deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>contact</td>
<td>91 (41.4) [43:48]</td>
<td>64 (29.1) [37:27]</td>
</tr>
<tr>
<td>mild</td>
<td>17 (7.7) [8:9]</td>
<td>98 (44.5) [57:41]</td>
</tr>
<tr>
<td>moderate</td>
<td>0</td>
<td>11 (5) [7:4]</td>
</tr>
<tr>
<td>severe</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>contacting structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>artery</td>
<td>101</td>
<td>223</td>
</tr>
<tr>
<td>vein</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>dura mater</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>nerve</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>
emerged from the curved lower surface of the pons. As a solution to this issue, Tomii et al. measured the distance from the supraolivary fossette to the TZ by using a microscope. They found this distance to be 9.9 mm. Our finding was similar to theirs. We measured the distance from the supraolivary fossette to the REZ and found it to be 8.4 mm. This is a useful landmark for performing MVD at the TZ of the facial nerve.

Previous authors have stated that significant compression was observed in 8% of autopsies conducted in asymptomatic individuals. Our study has demonstrated that 5% of asymptomatic persons have a moderately deviated facial nerve. However, there were several individuals in whom the TZ was slightly compressed. It is speculated that HFS is not caused by slight compression of the TZ. The nerves in ~80% of individuals came in contact with some structures, especially in women (84.2%), which may result in a female predominance for HFS.

Tomii et al. also reported that 80% of contact points were located <6 mm distal from the most proximal point of the facial nerve. However, we found that the vessels diffusely contacted the nerve in the cisternal and meatal segments. We also found that there were some individuals in whom the contact point was at the TZ and only caused mild deviation.

Ryu et al. reported a rare case of HFS that was caused by vascular compression on the distal portion rather than the TZ. We are not sure whether compression of the distal portion of the facial nerve causes HFS given that in the present study there were individuals with such findings but no symptoms.

**Magnetic Resonance Imaging**

In the past, the use of conventional MR imaging has not proved useful in determining which patients with vascular contact might benefit from MVD because of a high prevalence of neurovascular compression in control individuals. In addition, a study of the combination of sequences on 1.5-T MR images for increasing accuracy of diagnosing neurovascular compression has not been perfected.

Recently, 3.0-T MR imaging has become available in clinical cases. With 3.0-T MR imaging, the resolution is twice as high as that obtained with 1.5-T MR imaging. In other words, we should reconfirm any MR imaging findings of neurological diseases by using 3.0-T MR imaging. In this study, the trigeminal and facial nerves were clearly observed on 3.0-T MR images in all individuals. Cadavers have been previously used for anatomical studies, but the data obtained in cadavers may be different from those obtained in living individuals because of fixation or manipulation during dissection. For these reasons, we believe that

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**TABLE 3**

**Correlation between age and each parameter**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Equation (age [x] vs measurement [y])</th>
<th>Correlation</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>trigeminal nerve length (mm)</td>
<td>y = 0.028x + 8.14</td>
<td>0.220</td>
<td>0.001†</td>
</tr>
<tr>
<td>interval (mm)</td>
<td>NA</td>
<td>−0.102</td>
<td>0.2893</td>
</tr>
<tr>
<td>angle (°)</td>
<td>NA</td>
<td>0.010</td>
<td>0.8797</td>
</tr>
<tr>
<td>facial nerve Length 1 (mm)</td>
<td>y = −0.015x + 9.21</td>
<td>−0.176</td>
<td>0.0087†</td>
</tr>
<tr>
<td>Length 2 (mm)</td>
<td>NA</td>
<td>−0.035</td>
<td>0.6041</td>
</tr>
<tr>
<td>length total (mm)</td>
<td>NA</td>
<td>−0.120</td>
<td>0.0762</td>
</tr>
<tr>
<td>interval (mm)</td>
<td>y = −0.032x + 30.42</td>
<td>−0.197</td>
<td>0.0387†</td>
</tr>
<tr>
<td>angle (°)</td>
<td>y = −0.062x + 73.077</td>
<td>−0.141</td>
<td>0.0329†</td>
</tr>
<tr>
<td>ratio</td>
<td>y = −0.0048x + 0.732</td>
<td>−0.388</td>
<td>&lt;0.0001†</td>
</tr>
</tbody>
</table>

* Correlations can be seen in the scatterplots in Figs. 3 and 5. Abbreviation: NA = not applicable.
† Statistically significant.
3.0-T MR imaging must produce images superior to those produced using 1.5-T MR imaging.

We also emphasize that vertical (sagittal/coronal) MR images can increase the accuracy of diagnosis as previously described by others. Most of the neurovascular compression in cases of TN and HFS is in the vertical plane. We should confirm these findings on vertical images at first, and then on axial images for ascertaining the amount of compression. Reconstructed 3D MR images are also useful.

Effects of Aging

Results of MVD in older individuals were similar compared with those of younger patients in the literature. However, some authors have stated that MVD in older individuals is easier to perform and a better outcome is attained than in the young because of brain atrophy and larger cisterns in the former, which minimize the retraction-related complications. Our results support these findings: brainstem atrophy may result in longer trigeminal nerves, a shorter distance between bilateral facial nerves, and a shorter measurement of Length 1 of facial nerves in older individuals.

Other authors have stated that TN occurred with a higher frequency in the elderly population. Given that we did not include symptomatic patients in our study, further study is needed with 3.0-T MR imaging.

Conclusions

Of 220 trigeminal nerves, 108 (49.0%) in 51 women and 57 men came in contact with vasculature. The length of the trigeminal nerve was significantly longer in the older individuals. Of facial nerves, 173 (78.6%) in 101 women and 72 men came in contact with vasculature. The proximal length of the facial nerve, interval, angle, and ratio were significantly shorter or smaller in older individuals than in younger individuals. Knowing the normal anatomy helps us to hone our diagnostic practices for MVD, which may increase the favorable results achieved after MVD surgery. We expect that further advances in MR imaging hardware and refinement of sequences will improve visualization of trigeminal/facial compression and provide additional preoperative details important for MVD procedures.

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Accepted July 11, 2007.
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