Middle Temporal Vein: A Fatal Hazard in Injection Cosmetic Surgery for Temple Augmentation

Because facial aesthetics procedures are trending away from open surgery toward injection surgery, the use of autologous fat has been developed and approved for the correction of facial contour as the newest and most popular dermal filler. Common complications (eg, infections, absorption, asymmetry) are either avoidable or reversible. However, the safety of this procedure is still under consideration owing to some rare but severe complications, such as blindness and cerebral fat embolism, which result from accidental injection into the artery, especially after temple augmentation. Fortunately, the incidence has decreased owing to raised awareness and care in following protocol. However, we have recently encountered another potentially fatal complication—nonthrombotic pulmonary embolism—in 3 cases, which manifested as acute respiratory failure after a cosmetic temple injection procedure using autologous fat by different medical practitioners. Of the 3 patients, 2 underwent local anesthesia and complained of sudden sweating, dyspnea, and tachypnea. The third patient, who had received general anesthesia, was found to have experienced cardiac respiratory arrest and died despite the best efforts of the physicians. The cause of death was confirmed by autopsy to have been pulmonary embolism.

To sound an alarm and to avoid more tragedy, we emphasize the culprit vessel: the middle temporal vein (MTV), a vein in the temporal region with nearly the same position in different patients, predisposes itself to injection owing to some anatomical characteristics detailed herein.

Methods | Gross anatomic dissections were performed on 10 formalin-fixed cadavers. The anatomical levels on coronal section and the position, distribution, caliber, and tributaries of the MTV were studied.

Results | The anatomical levels of the temple region include skin, subcutaneous adipose tissue, superficial muscular aponeurotic system, superficial temporal fascia, superficial layer of the deep temporal fascia, superficial temporal fat pad, deep layer of the deep temporal fascia, and temporalis muscle (Figure 1).

The MTV comes from 2 to 4 tributaries at the lateral orbital angle, passing backward, downward, and outward at the temple area, according to Longmore and McRae and our cadaveric study (Figure 2). Lifted by the superficial temporal fat pad—a quite dense connective tissue between the superficial and deep layers of the deep temporal fascia where the vein’s stem is embedded—the wall of the vein is thus kept dilated. Therefore, it does not collapse during dissection of the temple area before injection; even if the stem has broken down, it would not collapse like other veins, nor would it collapse while being injected, as the veins in marrow cavities do. The opening vessel on coronal section is shown in Figure 1.

Figure 1. A Coronal Incision Providing Exposure to the Temporal Structure for Plastic Surgeons
One of the tributaries, the STV4 lies lateral to the lateral orbital rim, passing from the subcutaneous layer through a perforation into the MTV (Figure 3), and possesses the same characteristic as the MTV, which is also a target of injection. Another risk factor for embolism is the relatively large caliber of the MTV. Starting with embouchement of the STV, which has a caliber of 2 mm, its stem can grow as wide as 3.15 ± 0.13 mm at the palpebral fissure plane according to Zihua Chen. In our cadaveric study, which observed the course and caliber of the MTV, we found it to be a mean (SD) of 2.06 (0.17) mm from the point of origin and a mean of 3.02 (0.23) mm at the palpebral fissure plane (Table).

**Table. Caliber of Middle Temporal Vein**

<table>
<thead>
<tr>
<th>Plane</th>
<th>Cadaver No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral orbital</td>
<td>Left</td>
<td>2.34</td>
<td>2.03</td>
<td>2.25</td>
<td>1.86</td>
<td>2.10</td>
<td>1.82</td>
<td>1.66</td>
<td>2.06</td>
<td>1.91</td>
<td>2.30</td>
<td>2.06 (0.17)</td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>2.08</td>
<td>2.22</td>
<td>1.97</td>
<td>2.03</td>
<td>2.14</td>
<td>2.03</td>
<td>1.94</td>
<td>2.25</td>
<td>2.11</td>
<td>2.14</td>
<td></td>
</tr>
<tr>
<td>Palpebral fissure</td>
<td>Left</td>
<td>3.31</td>
<td>3.14</td>
<td>3.28</td>
<td>2.86</td>
<td>2.95</td>
<td>2.94</td>
<td>2.66</td>
<td>2.86</td>
<td>2.96</td>
<td>3.23</td>
<td>3.02 (0.23)</td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>3.26</td>
<td>3.08</td>
<td>2.96</td>
<td>2.98</td>
<td>3.18</td>
<td>2.76</td>
<td>2.87</td>
<td>2.55</td>
<td>3.08</td>
<td>3.42</td>
<td></td>
</tr>
</tbody>
</table>

* Data are given as calibers in millimeters. There was no difference between right and left sides for either plane; \( P = .05 \) for both comparisons.

Another risk factor for embolism is the relatively large caliber of the MTV. Starting with embouchement of the STV, which has a caliber of 2 mm, its stem can grow as wide as 3.15 ± 0.13 mm at the palpebral fissure plane according to Zihua Chen. In our cadaveric study, which observed the course and caliber of the MTV, we found it to be a mean (SD) of 2.06 (0.17) mm from the point of origin and a mean of 3.02 (0.23) mm at the palpebral fissure plane (Table).

**Discussion**

A general yet region-specific knowledge of facial anatomy is a prerequisite to an aesthetic and safe outcome of an injection procedure. Only with awareness of the existence and relative anatomical knowledge of the vessel can one expect to avoid it on purpose. Use of a blunt-tip needle is recommended during the procedure to decrease the possibility of a puncture. One incision near the hairline is enough. The method we recommend is to use a long blunt-tip needle, totally injected into the area and injecting the autologous fat little by little while drawing back the needle. Use of multiple injection sites is a better choice than dissection of the temple area before injection to avoid the rupture of the vessel. Consider the possibility of this complication at any abnormal and unaccountable manifestation, discontinue the procedure, and begin emergency treatment (eg, close monitoring of heart rate, blood pressure, arterial blood gas level, and respiration via electrocardiogram) and symptomatic treatment (eg, administration of therapy to lower blood pressure, analgesics, and oxygen inhalation) to minimize the hazard.

Few articles have mentioned the MTV, especially its clinical significance. We sincerely hope that this report raises concern among all plastic surgeons to avoid the complication as much as possible.

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Author Contributions: Dr Jiang had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.  
Study concept and design: Jiang, Chen.  
Acquisition of data: All authors.  
Analysis and interpretation of data: Jiang, Liu.  
Drafting of the manuscript: Jiang, Chen.  
Critical revision of the manuscript for important intellectual content: All authors.  
Statistical analysis: All authors.  
Administrative, technical, and material support: Jiang, Chen.  
Study supervision: Liu, Chen.  
Conflict of Interest Disclosures: None reported.  

CORRECTION
Omission in Abstract: In the Original Investigation titled “Whisking Recovery After Automated Mechanical Stimulation During Facial Nerve Regeneration” published online January 9, 2014, and in the March/April issue of JAMA Facial Plastic Surgery (2014;16[2]:133-139. doi:10.1001/jamafacial.2013.2217), an entry was omitted from the Abstract. The entry, which should have appeared as the last one in the Abstract, should have read: “Level of Evidence NA.” This article was corrected online.

Omission in Abstract: In the Original Investigation titled “The Minimally Invasive, Orbicularis-Sparing, Lower Eyelid Recession for Mild to Moderate Lower Eyelid Retraction With Reduced Orbicularis Strength” published online January 16, 2014, and in the March/April issue of JAMA Facial Plastic Surgery (2014;16[2]:140-146. doi:10.1001/jamafacial.2013.2401), an entry was omitted from the Abstract. The entry, which should have appeared as the last one in the Abstract, should have read: “Level of Evidence 4.” This article was corrected online.