CT Angiography and 3D Time-of-Flight MR Angiography for Preembolization Evaluation of Traumatic Direct Carotid Cavernous Sinus Fistula

Chen, C. C. C. ¹ * Shy, C. ² * Lee, S. ¹
¹Taichung Veterans General Hospital, Taichung, Taiwan Republic of China; ²Pingtung Christain Hospital, Pingtung, Taiwan Republic of China

Purpose
Embolization is the elective procedure for traumatic direct carotid-cavernous sinus fistula (CCF). An accurate preembolization evaluation determines treatment planning such as balloon selection or vascular occlusion, which affects prognosis. The purpose of this study is to assess the value of preembolization CT angiography (CTA) and 3D time-of-flight (TOF) MR angiography (MRA) for the venous drainage, the size and location of the fistula shunt in these cases, with the emphasis on the source imaging findings.

Materials & Methods
Sixteen patients (8 men and 8 women; age range, 14 to 64 years old) with 17 angiographically proved direct CCFs received detachable balloon embolization. The duration between trauma to imaging diagnosis was 2 weeks to 10 years. The pre and postcontrast-enhanced CT, CTA, spin-echo MR imaging and 3D TOF MRA were performed before embolization. The size and location of the fistula shunt between the carotid artery and cavernous sinus was determined from the source images of CTA and MRA. These findings were then correlated to DSA and were used as guides to embolization.

Results
The dilated cavernous sinus, venous drainage, and venous aneurysm formation were demonstrated readily by CTA and MRA studies. From the source imaging of CTA and MRA, the location and size of connecting fistula tracts between carotid artery and engorged cavernous sinuses could be identified and was further confirmed by DSA procedure. Correlation of results was schemed in the table.

<table>
<thead>
<tr>
<th>Lesion detection / 17 imaging studies</th>
<th>Size and location of fistula shunt</th>
<th>Dilatation of superior ophthalmic vein</th>
<th>Engorged venous sinus drainage</th>
<th>Engorged cortical vein drainage</th>
<th>Venous aneurysm</th>
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</thead>
<tbody>
<tr>
<td>3D TOF MRA</td>
<td>11</td>
<td>14</td>
<td>12</td>
<td>2</td>
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<tr>
<td>CTA</td>
<td>15</td>
<td>15</td>
<td>11</td>
<td>4</td>
<td>3</td>
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<tr>
<td>DSA</td>
<td>15</td>
<td>15</td>
<td>14</td>
<td>6</td>
<td>3</td>
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</table>

Conclusion
Both CTA and MRA images are helpful in detection of venous drainage and aneurysm formation in traumatic direct CCFs. Moreover, the source image of CTA and 3D TOF MRA are valuable tools in the identification of size and location of fistula shunt which is crucial in the preembolization assessment, with the CTA imaging somewhat superior.

References