Endovascular Treatment of traumatic Carotid Cavernous Fistula-Experience at Aga Khan University Hospital, Pakistan.

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Purpose

To evaluate the technical success, complications and outcome of treatment in patients with carotid cavernous fistula (CCF) managed by endovascular techniques at our Institute.
Methods and Materials

This descriptive case series was carried out at Radiology and Neurosurgery departments of Aga Khan University hospital.

Medical records and images of those 26 patients were retrospectively reviewed who underwent endovascular treatment for carotid cavernous fistulas between November 2000 to December 2009.

All procedures were performed by senior interventional radiologist in angiography suite on a monoplane flat panel DSA unit (Axiom Artis angiography machine Seimen's corporation). Procedures were carried out under general anaesthesia via femoral artery approach in most patients. Venous approach was also adopted if required due to technical difficulty from arterial side. Initially diagnostic cerebral angiography was carried out in all patients using a 5 Fr headhunter catheter (Cordis Corporation) to define the vascular anatomy, site of fistula and status of collateral circulation. A 6 Fr guiding catheter (MPD, Cordis corporation) was placed in internal carotid artery close to the fistula and the fistula was tried to cross with a micro-catheter (Minitorque KTC 150 Minvasys) mounted with a detachable balloon (GoldValve, CathNet-Science, Paris, France) once the fistula was successfully crossed, the balloon was inflated in cavernous sinus and fistula was closed (Figure-1 and/or cyanoacrylate glue. In few patients where it was not possible to cross the fistula site or access cavernous sinus directly due to difficult anatomy and with an available good collateral flow via circle of Willis, the detachable balloon was inflated in distal segment of internal carotid artery of the affected side.

Procedural success was defined as complete closure of fistula, or near complete closure with very minimal residual fistula flow that was likely to undergo spontaneous thrombosis. Failure was defined as incomplete fistula occlusion with the presence of a residual shunt. Post procedure, patients were monitored in a special care unit and serial neurological examinations were carried out. Once clinical condition was stable, patients were discharged, to be followed as outpatient, where if required, angiographic examination and subsequent intervention procedures were also carried out.

For the purpose of this review, clinical records and radiology data was retrieved from medical records, various clinical as well as technical details were recorded on a standardized pre tested proforma. Technical success and safety of the procedure were analyzed and the final outcome, which was described in terms of symptomatic improvement, was recorded wherever available. The outcome was categorized as (a) complete resolution of symptoms (b) improvement and (c) no change. Subjective follow up was also obtained on telephone where the patient failed to follow up personally.

Data from patient's files and radiology reports was collected on performa and analyzed on SPSS version 16. Frequencies and percentages were calculated.
Results

Out of total 26 patients 20 were males and 6 females (age range from 14 to 62 years, mean age 31.4 ± 12.6 years). All patients presented with clinical features of raised ocular pressure and/or cranial nerve dysfunction and initial diagnosis was made on clinical grounds. Final diagnosis was made by CT, MRI or both and on the basis of digital subtraction angiography (DSA). Twenty three (88.4%) patients had direct fistula and three patients had indirect fistula. Technical success rate of endovascular embolization was 92.3% (24 of 26 procedures). In 2 patients, the embolization procedure was unsuccessful and could not be performed. In 19 patients, the procedure was carried out by arterial approach and in five patients, venous approach was adopted. In 19 patients detachable balloons were used for fistula closure (Table). In 17 (70.8%) patients the exact fistula site was successfully crossed and the embolic agent was deployed in cavernous sinus while in remaining seven (29.1%) patients the fistula could not be crossed and hence balloons or coils were deployed in the cavernous part of ipsilateral internal carotid artery.

<table>
<thead>
<tr>
<th>Embolic material</th>
<th>Number</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Detachable balloons only</td>
<td>13</td>
<td>54.1</td>
</tr>
<tr>
<td>Detachable balloons and pushable coils</td>
<td>06</td>
<td>25</td>
</tr>
<tr>
<td>Pushable Coils only</td>
<td>03</td>
<td>12.5</td>
</tr>
<tr>
<td>Pushable coils and cyanoacrylate glue</td>
<td>02</td>
<td>8.3</td>
</tr>
</tbody>
</table>

In 20 out of 24 (83.3%) patients single session of embolization was sufficient while four patients required another session due to recurrence. In one of these four patients the detachable balloon deflated after 2 hours of deployment and another session of embolization was immediately carried out by deploying a larger sized balloon. Rest of the three patients underwent a repeat session after interval ranging from one week to 7 months.

<table>
<thead>
<tr>
<th>Complications</th>
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<tr>
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<tr>
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<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>Ischemic infarction</td>
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<td>3.8</td>
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<tr>
<td>Cranial nerve palsy</td>
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<td>7.6</td>
</tr>
<tr>
<td>Infective endophthalmitis</td>
<td>01</td>
<td>3.8</td>
</tr>
</tbody>
</table>
Images for this section:

Fig. 2: (a) Orbital congestion and swelling at presentation. (b) Marked symptomatic resolution on follow up 2 weeks after embolzation.

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**Fig. 3:** Right internal carotid angiogram (a) demonstrates simultaneous filling of cavernous sinus and superior ophthalmic vein. The fistula is also filling from branches of external carotid artery (b). Multiple coils and glue deployed in cavernous sinus from venous approach, note microcatheter in angular and ophthalmic veins (c). No residual venous filling in post embolization angiogram (d)

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Conclusion

Endovascular approach is a safe and useful option for treatment of traumatic carotid cavernous fistula.

