Posterior fossa AVMs; endovascular management challenges

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Background

• Posterior fossa arteriovenous malformations (AVMs) are complex neurovascular lesions

• Nearby eloquent areas

• Relatively infrequent < 15% of all AVMs

• More aggressive natural history
Background

“Cerebral arteriovenous malformation (AVM)”

- **Etiology:**
  
  Abnormality of primordial angiogenesis
  
  - Agenesis of capillary system
  
  - Retention of primordial vascular connections
Epidemiology

• 1/100,000 person/year (all detected)
• caused 2% of hemorrhagic stroke
• 2～4% annual rate of hemorrhage
• Enlargement/shrinkage rate: unknown
Global consensus

- To obtain Better outcome..

- Maximize Team Effort:
  - Microsurgery
  - Embolization
  - Radiosurgery
Patients and methods

- Between January 2012 to August 2015.

- 20 patients’ data with posterior fossa AVMs treated with *endovascular techniques*, radiosurgery and/or surgery were analyzed.
<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Presentation</th>
<th>Site</th>
<th>GCS</th>
<th>SMG</th>
<th>Feeder</th>
<th>Drainer</th>
<th>Procedure</th>
<th>Immediate Outcome</th>
<th>Obliteration %age</th>
<th>Complications</th>
<th>GOS</th>
<th>Follow up</th>
<th>Radiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>m</td>
<td>IVH, Cerebellar Hage</td>
<td>16</td>
<td>4th vent</td>
<td>15</td>
<td>Rt Cerebellar</td>
<td>3</td>
<td>2</td>
<td>Rt SCA, RI PICA, PICA An</td>
<td>Deep</td>
<td>Evacuation+onyx emb</td>
<td>FC, Intact</td>
<td>NO</td>
<td>NO</td>
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<td>16</td>
<td>f</td>
<td>IVH, Cerebellar Hage</td>
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<td>3rd vent</td>
<td>3</td>
<td>Rt Cerebellar</td>
<td>3</td>
<td>2</td>
<td>Rt SCA</td>
<td>Deep</td>
<td>Evacuation+onyx emb</td>
<td>FC, Intact</td>
<td>NO</td>
<td>NO</td>
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<tr>
<td>44</td>
<td>m</td>
<td>IVH</td>
<td>15</td>
<td>Lt cerebellar</td>
<td>1.5</td>
<td>Lt SCA</td>
<td>3</td>
<td>2</td>
<td>Lt SCA</td>
<td>Deep</td>
<td>Evacuation+onyx emb</td>
<td>FC, Intact</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>52</td>
<td>m</td>
<td>IVH, HCP</td>
<td>15</td>
<td>Lt cerebellar</td>
<td>3</td>
<td>Lt SCA</td>
<td>3</td>
<td>2</td>
<td>Lt SCA</td>
<td>Deep</td>
<td>Onyx embolization</td>
<td>FC, Intact</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

**Presentation**
- Headache

**Site**
- 3rd vent
- 4th vent

**GCS**
- 15

**SMG**
- 3

**Feeder**
- Rt SCA
- Lt SCA

**Drainer**
- Lt AICA, Lt SCA

**Procedure**
- Onyx embolization
- Evacuation+onyx emb

**Immediate Outcome**
- FC, Intact

**Obliteration %age**
- 90%

**Complications**
- No

**GOS**
- 5

**Follow up**
- No

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**Recurrent SAH**
- 50

**Presentation**
- IVH, HCP, Dist. Consc

**Site**
- 3rd vent

**GCS**
- 10

**SMG**
- 5

**Feeder**
- Lt AICA, PICA

**Drainer**
- Lt SCA, PICA

**Procedure**
- Onyx embolization
- VP Shunt & 3 sessions onyx emb

**Immediate Outcome**
- Improved gradually

**Obliteration %age**
- 90%

**Complications**
- No

**GOS**
- 5

**Follow up**
- No

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**Incidental**
- 14

**Presentation**
- Left Cerebellar

**Site**
- 3rd vent

**GCS**
- 15

**SMG**
- 4

**Feeder**
- Lt PICA, AICA, PICA

**Drainer**
- Lt SCA, PICA, SCA

**Procedure**
- Onyx embolization
- Evacuation+onyx emb

**Immediate Outcome**
- Improved gradually

**Obliteration %age**
- 90%

**Complications**
- 4

**GOS**
- 100%

**Follow up**
- 5

---

**Recurrent cerebellar hematoma**
- 24

**Presentation**
- Cerebellar Hematoma

**Site**
- 3rd vent

**GCS**
- 15

**SMG**
- 4

**Feeder**
- Lt SCA, PICA

**Drainer**
- Lt SCA, PICA

**Procedure**
- Onyx embolization, Surgical excision
- Partial evacuation of the hematoma and biopsy then one session onyx 2 ampoules

**Immediate Outcome**
- FC, Intact

**Obliteration %age**
- 50%

**Complications**
- P SAH, resolved completely

**GOS**
- 5

**Follow up**
- 5

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**Venous hypertension, large head, sinus pericranii**
- 1.3

**Presentation**
- Headache

**Site**
- Superior vermis

**GCS**
- 15

**SMG**
- 3

**Feeder**
- Bilateral SCA, Lt PICA

**Drainer**
- Lt PICA

**Procedure**
- Onyx embolization
- Evacuation+onyx emb

**Immediate Outcome**
- FC, Intact

**Obliteration %age**
- 75%

**Complications**
- temporary repeated vomiting

**GOS**
- 75%

**Follow up**
- 5

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**Cerebellar hematoma, disturbed conscious level**
- 22

**Presentation**
- Headache

**Site**
- Upper cerebellar surface

**GCS**
- 9

**SMG**
- 1

**Feeder**
- Left pica, Bilateral SCA

**Drainer**
- Left pica, Bilateral SCA

**Procedure**
- Onyx embolization
- Evacuation+onyx emb

**Immediate Outcome**
- FC, Intact

**Obliteration %age**
- total

**Complications**
- No

**GOS**
- 5

**Follow up**
- No

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**Recurrent SAH**
- 50

**Presentation**
- IVH, HCP, Dist. Consc

**Site**
- 3rd vent

**GCS**
- 10

**SMG**
- 5

**Feeder**
- Lt AICA, PICA

**Drainer**
- Lt SCA, PICA

**Procedure**
- Onyx embolization
- VP Shunt & 3 sessions onyx emb

**Immediate Outcome**
- Improved gradually

**Obliteration %age**
- 90%

**Complications**
- No

**GOS**
- 5

**Follow up**
- No

---

**Incidental**
- 14

**Presentation**
- Cerebellar Hematoma

**Site**
- 3rd vent

**GCS**
- 15

**SMG**
- 4

**Feeder**
- Lt PICA, AICA, PICA

**Drainer**
- Lt SCA, PICA

**Procedure**
- Onyx embolization
- Evacuation+onyx emb

**Immediate Outcome**
- Improved gradually

**Obliteration %age**
- 90%

**Complications**
- 4

**GOS**
- 100%

**Follow up**
- 5
Results

TREATMENT MODALITY

- Surgery only: 45%
- Onyx only: 20%
- Coiling of associated AN: 15%
- Onyx then surgery: 10%
- Onyx then GN: 5%
- NBCA then GN: 5%
Results

DIFFICULTIES IN ENDOVASCULAR TREATMENT

- Catheter navigation in SCA: 3
- Catheter navigations in AICA: 2
- Catheter navigations in PICA: 2
- Identifications of onyx in WA: 1
## Challenges

<table>
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<tr>
<th>challenges</th>
<th>How to solve</th>
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| Proximal access in the VA       | -5F guiding with soft tip  
- Transbrachial artery in right sided VA access                                    |
| Navigation                      | Detachable tip microcatheter  
Try smaller .007 hybrid                                                   |
| MCR Catheter stuck in the nidus | Detachable tip microcatheter                                                |
| Visualization of onyx flow     | Shack well before use  
Use flat panel angio machine  
Blank map                                                                |
| Proximal Reflux of LE agent     | **Not well defined**  
PICA after second lobe  
As distal as possible; Nidal wedging  
Detachable tip microcatheter – 3rd marker  
Nondetachable tip MCR 0.5-1 cm  
In cm from brain stem ?! **Working on**                                           |
| Extravasation                   | Not under pressure  
Drop like accumulation  
Better user Phil                                                              |
Example of tortuousity (AICA)
Example of tortuousity (SCA)
Example of post fossa AVM total occlusion in two session using onyx
A 28 years female patient presented during the second month of pregnancy with acute hemiataxia. CT brain showed Left cerebellar hematoma. DSA showed Lt hemispheric cerebellar AVM supplied by hemispheric branches of Posterior Inferior Cerebellar Artery (PICA) and small branch from the superior cerebellar artery. Onyx embolization was done and eventual near complete obliteration was achieved. Patient has marked symptomatic improvement 6 months later.
Example of subtotal occlusion of posterior fossa AVM using onyx in one session
Example of subtotal occlusion of posterior fossa AVM using onyx in one session ©
The task is difficult but **not** (mission impossible).

- Careful study of angiogram & use the best WA and best easy access main feeder first.
- Precise controlled intra-nidal injection to be strongly considered.
- Consider the use of detachable tip MCR catheter.
- The controllability & diffusability of the LE Agent (phil>onyx>nBCA).
Conclusion©

• Multiple sessions on intervals is generally better in multifeeder AVM.

• Give the patient the best chance by Using all tools; donot be dogmatic (only endovascular!!!!)

Thanks