Results of the TRAIL Multicenter, Observational Study

Michel Piotin, Christina Iosif, Charbel Mounayer for the TRAIL Investigator Group
Trail Investigators

• Xavier Barreau (Bordeaux)
• Jacques Sedat, Yves Chau (Nice)
• Alain Bonafe, Paolo Machi, Carlos Riquelme, Vincent Costalat (Montpellier)
• Raphaël Blanc, Silvia Pistocchi, Bruno Bartolini (Paris, FOR)
• Hervé Brunel (Marseille)
• Mohamed Aggour (Saint-Etienne)
• Nader Sourour (Paris, PSP)
• Laurent Pierot, Krystof Kadziolka (Reims)
• Suzana Saleme (Limoges)

CoreLab
André Gaston & Sophie Gallas (Créteil)
Inclusion criteria

Patients harboring ruptured or unruptured intracranial aneurysms for which:

- The parent artery has a diameter $\geq 2.0\text{mm}$ and $\leq 4.5\text{ mm}$
- Aneurysm neck size $\geq 4\text{mm}$ or dome-to-neck ratio $< 2$ (wide neck)
- Endovascular treatment by coils and one or more LVIS devices has been judged necessary to the patient
- Patient aged 18 or more
- Patient presenting with a WFNS score between 0 and 3
- The patient has accepted to be followed up
Exclusion criteria

The use of endovascular stent other than LVIS has been judged necessary

- Patient presenting with medical or surgical co-morbidities limiting his life expectancy to less than 12 mo
- CI to platelet inhibition treatment
- Patient requiring a re-treatment of an aneurysm previously treated with a stent
- Pregnancy
- Multiple aneurysms treated in one session
LVIS and LVIS Jr

- Ø 2.5 mm, suitable for vessels ranging from 2.0 to 2.5mm
- Ø 3.5 mm, suitable for vessels ranging from 2.5 to 3.5mm
- Ø 4.5 mm, suitable for vessels ranging from 3.0 to 4.5mm
- Ø 5.5 mm, suitable for vessels ranging from 4.0 to 5.5mm
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total N=90 patients / 90 treated aneurisms / 104 stents used / 92 stents placed</td>
<td></td>
</tr>
<tr>
<td>Number of aneurysms treated per patient – n (%)</td>
<td>90 (100.00)</td>
</tr>
<tr>
<td>• 1</td>
<td>90 (100.00)</td>
</tr>
<tr>
<td>Number of stents used per patient – n (%)</td>
<td>90 (100.00)</td>
</tr>
<tr>
<td>• 1</td>
<td>76 (84.44)</td>
</tr>
<tr>
<td>• 2</td>
<td>14 (15.56)</td>
</tr>
<tr>
<td>Number of stents placed per patient – n (%)</td>
<td>90 (100.00)</td>
</tr>
<tr>
<td>• 0</td>
<td>3 (3.33)</td>
</tr>
<tr>
<td>• 1</td>
<td>82 (91.11)</td>
</tr>
<tr>
<td>• 2 (dual stent-telescopic)</td>
<td>5 (5.56)</td>
</tr>
<tr>
<td>Reasons for non-deployment of stents – number / total number of stents used</td>
<td>12 / 104</td>
</tr>
<tr>
<td>• Inappropriate selection of stent size</td>
<td>3 / 104</td>
</tr>
<tr>
<td>• Failure of deployment during positioning</td>
<td>3 / 104</td>
</tr>
<tr>
<td>• Technical issues : premature detachment</td>
<td>2 / 104</td>
</tr>
<tr>
<td>• Nonuse due to sterility issues</td>
<td>4 / 104</td>
</tr>
<tr>
<td>Type of stent placed – n (%)</td>
<td>92 (100.00)</td>
</tr>
<tr>
<td>• LVIS</td>
<td>14 (15.22)</td>
</tr>
<tr>
<td>• LVIS Jr</td>
<td>87 (83.65)</td>
</tr>
<tr>
<td>Version of placed stents – n (%)</td>
<td>92 (100.00)</td>
</tr>
<tr>
<td>• Version A</td>
<td>44 (47.83)</td>
</tr>
<tr>
<td>• Version C</td>
<td>48 (52.17)</td>
</tr>
<tr>
<td>Treatment technique – n (%)</td>
<td>90 (100.00)</td>
</tr>
<tr>
<td>• Coiling passing through the stent LVIS (trans-stent)</td>
<td>13 (14.44)</td>
</tr>
<tr>
<td>• Coiling with the jailing technique</td>
<td>20 (22.22)</td>
</tr>
<tr>
<td>• Coiling and subsequent deployment of the LVIS stent (post-coiling)</td>
<td>3 (3.33)</td>
</tr>
<tr>
<td>• <strong>Balloon-assisted coiling before LVIS deployment</strong></td>
<td>47 (52.22)</td>
</tr>
<tr>
<td>• Y stenting</td>
<td>4 (4.45)</td>
</tr>
<tr>
<td>• Other</td>
<td>3 (3.33)</td>
</tr>
<tr>
<td>Number of used coils (mean ± s.d. [median])</td>
<td>6.40 ± 3.91 (6.00)</td>
</tr>
<tr>
<td>Use of other material – n (%)</td>
<td>90 (100.00)</td>
</tr>
<tr>
<td>• Distal catheter</td>
<td>30 (33.33)</td>
</tr>
<tr>
<td>• Guiding catheter</td>
<td>90 (100.00)</td>
</tr>
<tr>
<td>• Catheter with balloon</td>
<td>53 (58.89)</td>
</tr>
<tr>
<td>Succès du positionnement du cathéter pour les stents posés – n (%)</td>
<td>92 (100.00)</td>
</tr>
<tr>
<td>Anti-platelet regimen before endovascular treatment – n (%)</td>
<td>90 (100.00)</td>
</tr>
<tr>
<td>• AAS*</td>
<td>56 (62.22)</td>
</tr>
<tr>
<td>• Clopidogrel (Plavix)</td>
<td>72 (80.00)</td>
</tr>
<tr>
<td>• Prasugrel (Efient)</td>
<td>15 (16.67)</td>
</tr>
<tr>
<td>Anti-platelet regimen during endovascular procedure – n (%)</td>
<td>90 (100.00)</td>
</tr>
<tr>
<td>• AAS*</td>
<td>32 (35.56)</td>
</tr>
<tr>
<td>• Clopidogrel (Plavix)</td>
<td>1 (1.11)</td>
</tr>
</tbody>
</table>
Clinical evaluation / morbidity rate

- Minor neurological deterioration was defined as an increase of 1 point in the mRS score at 6 mo
- moderate deterioration by an increase of 2 points
- severe deterioration by an increase of more than 2 points
- Death and complication rate analysis were performed for patients in the intent-to-treat population (ITT analysis)
Included
N = 102 patients

Attributed to analysis
N = 90 patients

- Exit before analysis
  N = 0

- Treatment
  N = 90 patients
    - Premature exit before 6 months
      N = 8
    - Lost to FU
      N = 2

FU at 6 months
N = 80 patients
  - Premature exit before 18 months
    N = 4
    - FU at 18 months
      N = 34 patients

Patients non attributed to analysis
N = 12 patients

- Exclusion criterion:
  "Supplementary use of a second stent, other than the LVIS is programmed"
  N = 1

- Exclusion criterion:
  "Treatment other than with LVIS and coils is programmed"
  N = 3

- Exclusion criterion:
  "Multiple aneurysms treated in a single session"
  N = 8
Of the 90 patients analyzed

- 27 (30.0%) had multiple aneurysms
- 23 (25.6%) ruptured aneurysms
  - 4 (4.4%) ruptured aneurysms were in acute phase (ruptured for less than 30 days)
- 10% (9/90) of the aneurysms were large (≥ 10 mm) and 90.0% (81/90) were small (<10 mm)
- Previously treated aneurysms accounted for 31.1% (28/90)
- Aneurysms were mainly localized in the MCA (36.7%) and AcoA (35.6%).
Safety assessment results:

Clinical outcome

- Majority of patients graded mRS 0 at post-procedure (86.7%) at 6-month F/U (90.0%)
- 7.8% of patients had neurological deterioration in the post-operative period
- 2.5% at 6-month
- MRS score did not vary significantly between post-procedure and 6 mo F/U (0.01 ± 0.41 point)
Safety assessment results: Mortality

- 1 procedure-related death (1/90, 1.1%) during post-procedural hospitalization (mesencephalic ischemia at day 1)
- 4 deaths (4/90, 4.4%), unrelated to the endovascular technique occurred during follow up:
  - 1 occurred at the day of the procedure (PE)
  - 1 during the 6-month follow-up (cancer)
  - 2 at 9-19 months post-procedure (cancer)
- mortality rate at 6-mo in the study was 5.5%
- procedure-related mortality rate was 1.1%
- no difference in mortality rates according to the type or version of stent placed (Fisher exact test: p=0.39) at 6 mo
Adverse events and procedure-related morbidity

- Adverse events (AEs) per-procedure were reported in 27.8% (25/90) patients and 6 AEs were reported during the 6-mo F/U (6.7%, 6/90)
- 34 adverse events were reported overall, involving 31/90 patients (34.4%)
- No difference in the adverse event rate depending on the type or version of stent placed post-procedure or at 6-mo (p=0.35)
- Of the 34 AE, 4 (11.8%) were unexpected and half (50%, 17/34) were vascular
  - aneurysm rupture: 1
  - arterial occlusive disease: 3
  - arterial rupture: 1
  - artery dissection: 2
  - cerebral hematoma: 1
  - stroke: 3
  - hypertension: 1
  - stent embolization: 3
  - TIA: 1
  - venous insufficiency: 1
- Among the 34 adverse events, 4 events in 4 patients (4.4%, 4/90) resulted in permanent morbidity (healing with sequels or not resolved) at 6-mo
- Permanent complication rate was attributed as being 4.4% at 6-mo
- Permanent morbidity rate at 6-mo (defined as mRS score >2) was 1.2% (1/90)
CoreLab adjudicated Aneurysm Occlusion Rates

<table>
<thead>
<tr>
<th>Aneurysm occlusion rate</th>
<th>Post procedure (N=90 patients)</th>
<th>At 6-month FU (N=79 patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p-value = 0.43</td>
<td></td>
</tr>
<tr>
<td>Missing data</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total occlusion – n (%)</td>
<td>80 (90.91) [82.85 ; 95.55]</td>
<td>70 (90.91) [82.14 ; 95.80]</td>
</tr>
<tr>
<td>C.I.</td>
<td></td>
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<tr>
<td>Residual neck – n (%)</td>
<td>8 (9.09) [4.45 ; 17.15]</td>
<td>4 (5.19) [1.64 ; 13.00]</td>
</tr>
<tr>
<td>Residual aneurysm – n (%)</td>
<td>0</td>
<td>3 (3.90) [0.88 ; 11.30]</td>
</tr>
</tbody>
</table>

- absence of statistically significant difference (Fisher’s exact test: p=1.00) between LVIS and LVIS Jr
- The same for comparison of the 2 stent versions (A and C) regarding aneurysm occlusion rates at six months (Fisher’s exact test: p=0.95)
- The aneurysm’s size (small or large) did not seem to play a role in the 6-mo imaging outcome, regarding occlusion rate (Fisher’s exact test: p=0.0739)
- None of aneurysms treated in the study was deemed amenable to re-treatment
CoreLab Adjudicated Parent Artery Patency

• immediate post-procedure and 6-mo F/U showed patency of the parent artery in 95.4% and 100.0% of the cases, respectively

• 3 patients had parent artery occlusion following the endovascular procedure
  – 1 had stent thrombosis without any possibility of arterial recanalization
  – 1 underwent parent artery occlusion (dissection with thrombosis of the ACA
  – 1 had partial in-stent thrombosis, resulting in occlusion of basal ganglia perforators and distal emboli, resulting in hemiplegia. The patient refused imaging F/U.
Conclusions

• LVIS and LVIS Jr devices have been shown to be safe and effective in the treatment of complex ruptured and unruptured intracranial aneurysms

• high immediate and mid-term total exclusion rates
F 46
2 anévrismes fortuits
1 sylvien droit de 6 mm
1 AcoA de 3 mm
Septer C dans la branche de division inférieure
Fin d’intervention
Contrôle à 18 mois
F 63
Anévrisme fortuit de l’AcoA
Occlusion chronique CID
S40 FAUX PROFIL GAUCHE APRÈS STENTS
MERCI