ChEVAR Vs. fEVAR for juxtarenal Aneurysm

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CHU bordeaux
CH-EVAR VS. F-EVAR IN JAAAs

Meta-analysis, 2001-2012
- 5 CH-EVAR studies (94 patients, 151 target vessels)
- 10 F-EVAR studies (931 patients, 2465 target vessels)

- Target vessel preservation: 98.0% vs. 98.6%
- 30-day mortality: 5.3% vs. 2.4%
- Impaired renal function: 12% vs. 9.8%
- New-onset dialysis: 2.5% vs. 1.5%
- Postoperative cardiac complications: 7.4% vs. 3.7%
- Ischemic stroke: 3.2% vs. 0.3%, p=0.012
- EARLY type Ia ELs: 10% vs. 4.3%, p=0.002

NS differences between CH-EVAR and F-EVAR:
- Target vessel preservation
- 30-day mortality
- Renal impairment
- Post-operative cardiac complications
BUT more EARLY type Ia EL and ischemic stroke
CH-EVAR VS. F-EVAR IN JAAAs

Meta-analysis, up to 2012:

- 5 CH-EVAR studies (123 patients)
- 12 F-EVAR studies (660 patients)

30-day procedure-related mortality: 0.58% vs. 1.17%

Post-operative renal impairment: 12.43% vs. 9.67%

Persistant post-operative hemodialysis: 0.57% vs. 1.33%

PERSISTANT type Ia ELs: 1.93% vs. 2.06%

type II ELs: 2.16% vs. 6.88%

type III ELs: 0% vs. 0.32%

NS differences between CH-EVAR and F-EVAR:
- 30-day mortality
- renal impairment
- EL
Restrospective study, 2006-2013

- 38 CH-EVAR patients
  - 15.8% treated in emergency, $p = 0.002$
- 80 F-EVAR patients

Aneurysm diameter: $65.9 \pm 15.3$ mm vs. $58.6 \pm 8.6$ mm, $p = 0.003$

Mean number of reconstructed vessels/patient: $1.6 \pm 0.7$ vs. $2.4 \pm 0.7$, $p < 0.0001$

30-day mortality: 7.9% vs. 6.3%

Moderate to severe complications: 39.5% vs. 27.5%

Median follow-up duration: 12 months vs. 14 months

2-years results:

- Estimated survival: 71.8% vs. 77.3%
- Freedom from reintervention: 72.0% vs. 71.4%
- Reconstructed vessel event-free rates: 84.1% vs. 90.5%
- Primary patency of reconstructed vessels: 87.6% vs. 97.1%
- Sac shrinkage ($\geq 5$ mm): 30.6% vs. 43.4%

NS differences between CH-EVAR and F-EVAR in terms of short-term and mid-term results
**THE EXPERIENCE WITH CH-EVAR AND F-EVAR TREATMENT OF JAAAs IN OUR CENTER**

- **121 high risk-patients from January 2010-2015**

- **Groups comparable except:**
  - **Male:** F-EVAR > CH-EVAR
  - **Age:** CH-EVAR > F-EVAR

- **Indications for CH-EVAR:**
  - History of prior aortic surgery
  - Emergency for contained rupture
  - Aneurysm diameter >70mm: 9 patients (28.1%)

<table>
<thead>
<tr>
<th>Variables</th>
<th>F-EVAR n = 90</th>
<th>CH-EVAR n = 31</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>88 (98)</td>
<td>26 (84)</td>
<td>0.013</td>
</tr>
<tr>
<td>Age (years)</td>
<td>71.33 ± 8.16</td>
<td>75.26 ± 6.52</td>
<td>0.021</td>
</tr>
<tr>
<td>Cardiopathy</td>
<td>33 (37)</td>
<td>12 (39)</td>
<td>0.78</td>
</tr>
<tr>
<td>Hypertension</td>
<td>72 (80)</td>
<td>22 (74)</td>
<td>0.72</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>55 (61)</td>
<td>21 (68)</td>
<td>0.57</td>
</tr>
<tr>
<td>Diabetes</td>
<td>14 (16)</td>
<td>3 (10)</td>
<td>0.37</td>
</tr>
<tr>
<td>BMI ≥ 25</td>
<td>63 (70)</td>
<td>16 (52)</td>
<td>0.055</td>
</tr>
<tr>
<td>PAD</td>
<td>8 (9)</td>
<td>2 (6)</td>
<td>0.70</td>
</tr>
<tr>
<td>Renal insufficiency</td>
<td>11 (12)</td>
<td>8 (26)</td>
<td>0.067</td>
</tr>
<tr>
<td>Hemodialysis</td>
<td>1 (1)</td>
<td>1 (3)</td>
<td>0.42</td>
</tr>
<tr>
<td>Hostile abdomen</td>
<td>16 (18)</td>
<td>6 (19)</td>
<td>0.81</td>
</tr>
<tr>
<td>Current smoking</td>
<td>22 (24)</td>
<td>9 (29)</td>
<td>0.57</td>
</tr>
<tr>
<td>COPD</td>
<td>21 (23)</td>
<td>10 (32)</td>
<td>0.30</td>
</tr>
<tr>
<td>ASA ≥ 3</td>
<td>47 (52)</td>
<td>17 (55)</td>
<td>0.72</td>
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<table>
<thead>
<tr>
<th>Indications</th>
<th>F-EVAR n = 90</th>
<th>CH-EVAR n = 31</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior aortic surgery</td>
<td>3 (3)</td>
<td>5 (16)</td>
<td>0.013</td>
</tr>
<tr>
<td>Emergent setting</td>
<td>0 (0)</td>
<td>4 (13)</td>
<td>0.001</td>
</tr>
<tr>
<td>Aneurysm diameter</td>
<td>58.29 ± 9.78</td>
<td>67.58 ± 17.48</td>
<td>0.0004</td>
</tr>
</tbody>
</table>
## RECONSTRUCTED TARGET VESSELS

### Cannulation success: 94.9% vs 99.0% (p=0.073)

<table>
<thead>
<tr>
<th>Variables</th>
<th>F-EVAR</th>
<th>CH-EVAR</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nb of target vessels/patient</td>
<td>0</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>56</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mean nb/patient</td>
<td>3.02 ± 0.61</td>
<td>1.29 ± 0.52</td>
<td>&lt; 0.0001</td>
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</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>CT</th>
<th>SMA</th>
<th>LRA</th>
<th>RRA</th>
<th>Total</th>
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<tbody>
<tr>
<td><strong>F-EVAR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>271</td>
</tr>
<tr>
<td>Scallop</td>
<td>14</td>
<td>59</td>
<td>0</td>
<td>0</td>
<td>73</td>
</tr>
<tr>
<td>Standard fenestration</td>
<td>4</td>
<td>14</td>
<td>89</td>
<td>89</td>
<td>196</td>
</tr>
<tr>
<td>Covered ostium</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>CH-EVAR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>39</td>
</tr>
<tr>
<td>Open chimney</td>
<td>0</td>
<td>3</td>
<td>17</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>Covered chimney</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Covered ostium</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Cannulation success: 94.9% vs 99.0% (p=0.073)
PERI-OPERATIVE RESULTS

<table>
<thead>
<tr>
<th>Variables</th>
<th>F-EVAR</th>
<th>CH-EVAR</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time (min)</td>
<td>181.69 ± 90.71</td>
<td>139.65 ± 55.68</td>
<td>0.019</td>
</tr>
<tr>
<td>Fluoroscopy time (min)</td>
<td>63.93 ± 33.32</td>
<td>45.95 ± 22.76</td>
<td>0.022</td>
</tr>
<tr>
<td>Iodinated contrast agent (mL)</td>
<td>135.67 ± 59.41</td>
<td>92.11 ± 32.04</td>
<td>0.001</td>
</tr>
<tr>
<td>Dosimetry (cGy/cm²)</td>
<td>19739 ± 15055</td>
<td>16605 ± 17540</td>
<td>0.41</td>
</tr>
<tr>
<td>Length of stay in ICU (d)</td>
<td>1.86 ± 3.38</td>
<td>2.81 ± 6.69</td>
<td>0.3</td>
</tr>
<tr>
<td>Length of hospital stay (d)</td>
<td>8.03 ± 5.51</td>
<td>37.04 ± 97.08</td>
<td>0.006</td>
</tr>
</tbody>
</table>

- **CH-EVAR < F-EVAR**:
  - Op. Time
  - Amount of iodinated contrast agent
  - Fluoroscopy time

- But less reconstructed vessels

- Hospit. stay: F-EVAR < CH-EVAR

- But more patients treated in emergency
Higher peri-operative mortality rate in CH-EVAR:
- 1 acute mesenteric ischemia
- 1 iliac rupture
- 1 cardiac arrest
- 1 acute pulmonary heart
- 1 multiple post operative cerebral emboli

But Emergent setting + hostile anatomy

Renal function: No difference in terms of AKI or CKD

One tip over hemodialysis in each group (stents thrombosis)

### PERI-OPERATIVE COMPLICATIONS

<table>
<thead>
<tr>
<th>Variables</th>
<th>F-EVAR</th>
<th>CH-EVAR</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target vessels</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannulation failure</td>
<td>1 (0.37)</td>
<td>0 (0)</td>
<td>0.71</td>
</tr>
<tr>
<td>Stenting failure</td>
<td>1 (0.37)</td>
<td>1 (3.1)</td>
<td>0.11</td>
</tr>
<tr>
<td>Dissection</td>
<td>1 (0.37)</td>
<td>0 (0)</td>
<td>0.71</td>
</tr>
<tr>
<td><strong>Target organs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parenchymal hematoma</td>
<td>1 (1.1)</td>
<td>0 (0)</td>
<td>0.57</td>
</tr>
<tr>
<td>Acute mesenteric ischemia</td>
<td>2 (2.2)</td>
<td>1 (3.1)</td>
<td>0.77</td>
</tr>
<tr>
<td><strong>Access vessels</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemanatoma</td>
<td>3 (3.3)</td>
<td>2 (6.2)</td>
<td>0.47</td>
</tr>
<tr>
<td>Pseudo-aneurysm</td>
<td>1 (1.1)</td>
<td>2 (6.2)</td>
<td>0.105</td>
</tr>
<tr>
<td>Iliac dissection</td>
<td>1 (1.1)</td>
<td>0 (0)</td>
<td>0.57</td>
</tr>
<tr>
<td>Iliac rupture</td>
<td>0 (0)</td>
<td>1 (3.1)</td>
<td>0.094</td>
</tr>
<tr>
<td>Acute limb ischemia</td>
<td>2 (2.2)</td>
<td>2 (6.2)</td>
<td>0.27</td>
</tr>
<tr>
<td>Major rhabdomyolysis</td>
<td>2 (2.2)</td>
<td>0 (0)</td>
<td>0.41</td>
</tr>
<tr>
<td><strong>Comorbidity decompensation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enteric bleeding</td>
<td>1 (1.1)</td>
<td>0 (0)</td>
<td>0.57</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1 (1.1)</td>
<td>2 (6.2)</td>
<td>0.105</td>
</tr>
<tr>
<td>Cerebral stroke</td>
<td>0 (0)</td>
<td>1 (3.1)</td>
<td>0.094</td>
</tr>
<tr>
<td><strong>Peri-operative mortality</strong></td>
<td>3 (3.3)</td>
<td>5 (15.6)</td>
<td>0.015</td>
</tr>
</tbody>
</table>
FREEDOM FROM REINTERVENTION (K-M)

![Graph showing freedom from reintervention over follow-up months with CH-EVAR and F-EVAR data points.]

Log-rank = 0.431

<table>
<thead>
<tr>
<th>FU (mo)</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
<th>36</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH-EVAR</td>
<td>78.9%</td>
<td>78.9%</td>
<td>78.9%</td>
<td>78.9%</td>
<td>78.9%</td>
<td>78.9%</td>
</tr>
<tr>
<td>F-EVAR</td>
<td>94.2%</td>
<td>92.1%</td>
<td>86.4%</td>
<td>83.0%</td>
<td>79.3%</td>
<td>64.6%</td>
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</table>

NS
SURVIVAL RATE (K-M)

<table>
<thead>
<tr>
<th>FU (mo)</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
<th>36</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH-EVAR</td>
<td>79%</td>
<td>79%</td>
<td>73.4%</td>
<td>73.4%</td>
<td>66%</td>
<td>66%</td>
</tr>
<tr>
<td>F-EVAR</td>
<td>95.0%</td>
<td>91.4%</td>
<td>84.6%</td>
<td>81.5%</td>
<td>74.2%</td>
<td>59%</td>
</tr>
</tbody>
</table>

Log-rank = 0.18

NS
FREEDOM FROM RUPTURE (K-M)

Follow-up (months)

<table>
<thead>
<tr>
<th>FU (mo)</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
<th>36</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH-EVAR</td>
<td>92.5%</td>
<td>92.5%</td>
<td>92.5%</td>
<td>92.5%</td>
<td>92.5%</td>
<td>92.5%</td>
</tr>
<tr>
<td>F-EVAR</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
</tr>
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</table>

Log-rank = 0.078

NS
STENTED TARGET VESSELS’ PATENCY (K-M)

Log-rank = 0.182

<table>
<thead>
<tr>
<th>FU (mo)</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
<th>36</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH-EVAR</td>
<td>94.9%</td>
<td>89.6%</td>
<td>89.6%</td>
<td>89.6%</td>
<td>89.6%</td>
<td>89.6%</td>
</tr>
<tr>
<td>F-EVAR</td>
<td>97.3%</td>
<td>96.5%</td>
<td>96.5%</td>
<td>96.5%</td>
<td>93.6%</td>
<td>93.6%</td>
</tr>
</tbody>
</table>
ENDOLEAKS

**Type I EL**

- CH-EVAR:
  - 1 mo: 0%
  - 6 mo: 0%
  - 12 mo: 0%
  - 24 mo: 0%
  - 48 mo: 0%

- F-EVAR:
  - 1 mo: 0%
  - 6 mo: 0%
  - 12 mo: 0%
  - 24 mo: 0%
  - 48 mo: 0%

\( p = 0.018 \)

**Type II EL**

- CH-EVAR:
  - 1 mo: 0%
  - 6 mo: 0%
  - 12 mo: 0%
  - 24 mo: 0%
  - 48 mo: 0%

- F-EVAR:
  - 1 mo: 0%
  - 6 mo: 0%
  - 12 mo: 0%
  - 24 mo: 0%
  - 48 mo: 0%

\( p = 0.79 \)

**Type III EL**

- CH-EVAR:
  - 1 mo: 0%
  - 6 mo: 0%
  - 12 mo: 0%
  - 24 mo: 0%
  - 48 mo: 0%

- F-EVAR:
  - 1 mo: 0%
  - 6 mo: 0%
  - 12 mo: 0%
  - 24 mo: 0%
  - 48 mo: 0%

\( p = 0.417 \)
ANEURYSM SAC EVOLUTION

- 1 mo vs. 48 mo: $p < 0.0001$
- $\uparrow$ in: 76.9%

- 48 mo: $p = 0.002$
- 83.3% (p = 0.55)
CONCLUSION

- **CH-EVAR:**
  - Higher peri-operative mortality rates
  - Lower survival rate until 12 mo
  - **BUT** in older patients and emergent setting
  - After 24 mo: no more significant difference
  - Higher type I EL rates
  - **BUT** not associated with significant sac enlargement
  - With lower freedom from reintervention rate the first year

- **CH-EVAR & F-EVAR = complementary strategies**
  - Review of available data to date has been unable to demonstrate any reliable difference between both techniques

"Understanding which strategy might be applicable to which scenario, anatomy, or patient cohort will likely have the longest positive influence on the care of these complex patients"
WHEN TO CHOOSE WHAT?

Patient at High-risk for OSR:

- ASA ≥ 2
- Hostile abdomen
- COPD
- BMI > 25
- Cardiac insufficiency

F-EVAR is the first choice:

- Safe
- Effective
- Good long-term results even in high-risk patients

BUT some requirements need to be met...

- Favorable anatomy due to limitations in the configuration design:
  - Fenestration locations
  - Number of fenestrations
  - Neck angulation < 60°*

- Good bilateral iliac access: 18 to 24 Fr

- Advances endovascular skills

- Elevated cost

- Possibility to wait for the manufacturing delays of 6 to 12 weeks

- Only available in some centers, with a number of devices limited per year

*Ohrlander et al. J Endovasc Ther 2008
Patient uneligible for F-EVAR:

- **Emergent setting:**
  - Rapidly expanding AAA
  - Symptomatic AAA
  - (Contained) Ruptured AAA hemodynamically stable

- **ST-fenestrations quotas finished for the year with AAA > 70mm**

- **Unfavorable anatomy:**
  - History of prior aortic surgery with anastomotic pseudo-aneurysm
  - Angulated aortic neck > 60°
  - Hostile iliac access (diameter ≤ 8mm and high iliac tortuosity index)
  - Downward angulation of the target vessels ≤ -30°mm
  - Diameter of the target vessels ≤ 5mm
  - < 15mm between SMA and highest renal

*estimated annual risk of rupture > 30%, Moll et al. Eur J Vasc Endovasc Surg 2011
CH-EVAR is an effective solution:

- Device adaptability
- Available immediately
- Possible use of low profile devices in hostile iliac access
- Lower cost
- Similar technical success rate, short to mid-term morbidity and mortality

With some limitations:

- Off-label: inform patient and family, legal risk
- Preferably ≤ 2 chimneys to limit the risks of type Ia EL
- Absence of severe aortic arch angulation
- No long-term results: patency of target vessels? Type I EL through the gutters?

---

$$ Lachat et al. J Endovasc Ther 2013
* Katsargyris et al. J Endovasc Ther 2013
• THANK YOU FOR YOUR ATTENTION
ChEVAR Vs. fEVAR for juxtarenal Aneurysm

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CHU bordeaux