Tissue perfusion assessment drives and predicts clinical success in severe CLI: experience from a 330 patient study

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Speaker name: Efrem Gómez Jabalera

I have the following potential conflicts of interest to report:

- [ ] Consulting
- [ ] Employment in industry
- [ ] Stockholder of a healthcare company
- [ ] Owner of a healthcare company
- [ ] Other(s)

- [ ] I do not have any potential conflict of interest
INTRODUCTION

END POINTS

in endovascular treatment of critical limb threatening ischemia.

IDEALLY SHOULD BE:

Non-invasive

Objective

Periprocedural
INTRODUCTION

Perfusion Angiography is an image-processing software.

Analysis of density/pixel through time

Average value in a ROI $\rightarrow$ Curve $\rightarrow$ Parameters

1: Arrival Time
2: Peak Time
3: Wash-in Rate
4: Width
5: Area Under Curve
6: Mean Transit Time
ROI’s pixels
12 Vs 4
METHODS

Consecutive patients undergoing EVT for CLI (2 IR)
Only 1 explorer did the PA measures

**Inclusion criteria:** PA before and after EVT

**Exclusion criteria:**
Not meeting the thorough protocol for PA
Poor PA image quality
No ulcer (Rutherford 4)
Death or loss during follow-up

Demographic and clinical data recorded
Clinical follow-up at 1 and 6 months
METHODS

**Endpoint:** time to heal (TTH) of the ulcers.

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Follow-up at 1 month (N=293)</th>
<th>Follow-up at 6 months (N=293)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ulcer healing rate</td>
<td>160 (54.6%)</td>
<td>197 (70.6%)</td>
</tr>
<tr>
<td>TLR</td>
<td>23 (7.9%)</td>
<td>57 (20.6%)</td>
</tr>
<tr>
<td>AFS</td>
<td>293 (100%)</td>
<td>283 (96.6%)</td>
</tr>
</tbody>
</table>

**Groups for analysis:**
- TTH < 30 days (group A)
- TTH > 30 days (group B)

**Analysis:**
- **Student-t test:** changes before and after EVT
- Retrieve of best **cut-off points from ROC**
- **Chi square** crosstabs
RESULTS

- 1189 patients with EVT for CLI
  - 609 patients without PA
  - 580 patients undergone the PA protocol
    - Exclusion criteria: 248 patients
      - 21 deaths
      - 18 missing before healing
    - 332 patients without exclusion criteria
      - 293 patients for analysis
        - 250 patients with ulcers
        - 44 patients without ulcers
RESULTS

293 patients for analysis

Correct image post-treatment

Yes

Correct image pre-treatment

Any

Analysis of Δ PA parameters

N: 222

190 patients with ulcers

32 patients without ulcers

Analysis of post-EVT PA parameters

N: 246

209 patients with ulcers

37 patients without ulcers
## RESULTS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>72.2 ± 10.4 yo</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>68.6%</td>
</tr>
<tr>
<td><strong>BMI (Kg/m²)</strong></td>
<td>27.2 ± 4.5</td>
</tr>
<tr>
<td><strong>Smokers</strong></td>
<td>35.8%</td>
</tr>
<tr>
<td><strong>Former smokers</strong></td>
<td>52.2%</td>
</tr>
<tr>
<td><strong>DM</strong></td>
<td>92.8%</td>
</tr>
<tr>
<td><strong>Hypertension</strong></td>
<td>95.6%</td>
</tr>
<tr>
<td><strong>Atrial fibrillation</strong></td>
<td>20.1%</td>
</tr>
<tr>
<td><strong>Chronic kidney disease</strong></td>
<td>50.2%</td>
</tr>
<tr>
<td><strong>End-stage renal disease</strong></td>
<td>9.2%</td>
</tr>
<tr>
<td><strong>Ischemic cardiomyopathy</strong></td>
<td>39.6%</td>
</tr>
<tr>
<td><strong>Cerebrovascular disease</strong></td>
<td>27.6%</td>
</tr>
<tr>
<td><strong>Autoimmune disease</strong></td>
<td>6.1%</td>
</tr>
</tbody>
</table>

Rutherford 5: 133  
Rutherford 6: 76  
*No differences between groups (p=0.094)*

WIfI stage (risk of amputation)  
Low and Moderate: 54  
High: 155  
*No differences between groups (p=0.478)*
RESULTS

TASC classifications

FP before EVT

- No lesions: 35.9%
- A: 10.6%
- B: 14.3%
- C: 18.1%
- D: 16.4%

FP after EVT

- No lesions: 93.6%
- A: 2.4%
- B: 1.4%
- C: 2.4%
- D: 0.3%

BTK before EVT

- No lesions: 10.9%
- A: 21.5%
- B: 21.8%
- C: 9.9%
- D: 35.9%

BTK after EVT

- No lesions: 95.9%
- A: 2.4%
- B: 1.4%
- C: 2.4%
- D: 0.7%
RESULTS

preoperative WIFl  WIFl at 1 month  WIFl at 6 month

High  Moderate  Low

High  Moderate  Low

Very low  Low  Moderate  High

Very low
## RESULTS

<table>
<thead>
<tr>
<th></th>
<th>TTH &gt; 30 days Mean ± SD</th>
<th>TTH&lt;30 days Mean ± SD</th>
<th>p value</th>
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</thead>
<tbody>
<tr>
<td>AT</td>
<td>6.1 ± 2.6</td>
<td>7.3 ± 3.1</td>
<td>0.004</td>
</tr>
<tr>
<td>PT</td>
<td>4.6 ± 1.5</td>
<td>5.1 ± 1.7</td>
<td>0.014</td>
</tr>
<tr>
<td>WS</td>
<td>36.9 ± 31.2</td>
<td>31.3 ± 36.2</td>
<td>0.197</td>
</tr>
<tr>
<td>W</td>
<td>3.7 ± 1.1</td>
<td>3.9 ± 1.1</td>
<td>0.128</td>
</tr>
<tr>
<td>AUC</td>
<td>6210.2 ± 6549.3</td>
<td>5724.1 ± 4815.5</td>
<td>0.582</td>
</tr>
<tr>
<td>MTT</td>
<td>4.9 ± 1.5</td>
<td>5.4 ± 1.7</td>
<td>0.022</td>
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<td>AUC/s</td>
<td>0.54 ± 0.59</td>
<td>0.43 ± 0.36</td>
<td>0.113</td>
</tr>
<tr>
<td>∆AT</td>
<td>-2.8 ± 2.7</td>
<td>-2.7 ± 3.5</td>
<td>0.714</td>
</tr>
<tr>
<td>∆PT</td>
<td>0.13 ± 4.5</td>
<td>1.14 ± 1.9</td>
<td>0.009</td>
</tr>
<tr>
<td>∆WS</td>
<td>8.7 ± 22.2</td>
<td>6.6 ± 22.1</td>
<td>0.112</td>
</tr>
<tr>
<td>∆W</td>
<td>0.47 ± 1.2</td>
<td>0.78 ± 1.36</td>
<td>0.037</td>
</tr>
<tr>
<td>∆AUC</td>
<td>3059.2 ± 6222.2</td>
<td>2973.7 ± 4517.5</td>
<td>0.862</td>
</tr>
<tr>
<td>∆MTT</td>
<td>0.6 ± 1.7</td>
<td>1.23 ± 1.9</td>
<td>0.01</td>
</tr>
<tr>
<td>∆AUC/s</td>
<td>0.3 ± 0.51</td>
<td>0.25 ± 0.32</td>
<td>0.756</td>
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Student-t test for postEVT parameters and Mann-Whitney for ∆ parameters.
RESULTS

Statistically significant variables

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RESULTS

Cut-off points from ROC curves

- Arrival Time > 6 s
- Peak Time > 5.2 s
- Mean Transit Time > 4.1 s
- Wash-in Speed > 20*
- Width > 3.6 s*
- Δ Peak Time > 1.5 s*
- Δ Width > 0.6 s*
- Δ Mean Transit Time > 1.7 s*

*Mann-Whitney test was used for these parameters.
CONCLUSIONS

Perfusion angiography can identify objectives measurements to predict wound healing in CLTI in less than 30 days.
CONCLUSIONS

Further studies needed

is PA measurement enough?
TAKE HOME MESSAGE:
What is perfusion?

Perfusion is not about the vessel, it is about the tissue.

It could lead to a paradigm shift.

HIGH FLOW

PERFUSION
Thank you!