Is the myocardial blush grade scored by the operator during primary PCI of prognostic value in patients with STEMI in routine clinical practice?

Marthe A. Kampinga

Department of Cardiology
University Medical Center Groningen, The Netherlands
Background

• Successful PCI restores epicardial blood flow but myocardial reperfusion remains frequently impaired

• Myocardial blush grade (MBG) is an angiographic parameter of myocardial perfusion. Multiple trials have shown the prognostic value of MBG scored by core laboratory

• No study has determined the prognostic value of MBG scored by the operator
Objective

We evaluated the relation between MBG scored by the operator and 1-year all cause mortality in patients with STEMI treated with primary PCI in routine clinical practice.
Methods

• Inclusion:
  • All patients with STEMI treated with primary PCI between January 2004 and July 2008
  • MBG scored by the operator during PCI procedure

• Endpoints:
  • Agreement between operator and core laboratory scoring
  • 1-year all cause mortality
Definition MBG

MBG: contrast density in the myocardial region of the infarct-related artery compared to regions of noninfarct-related arteries\(^1\).

0: no myocardial blush or persisting blush (staining)
1: minimal myocardial blush
2: moderate myocardial blush
3: normal myocardial blush

\(^1\) van ’t Hof et al. Circulation 1998
Results: flow diagram

2375 consecutive STEMI-patients treated with primary PCI between January 2004 and July 2008

2118 (89%) patients with available angiograms and assessed TIMI flow grade and MBG

743 patients not included in prospective trials

1375 patients included in prospective trials
# Results: patient characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>All patients n=2118</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>63±13</td>
</tr>
<tr>
<td>Male gender</td>
<td>71%</td>
</tr>
<tr>
<td>TIMI flow pre-PCI 0/1</td>
<td>67%</td>
</tr>
<tr>
<td>TIMI flow post-PCI 3</td>
<td>83%</td>
</tr>
<tr>
<td>Ischemic time, min</td>
<td>185 (135-285)</td>
</tr>
<tr>
<td>MBG scored by operator</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>12%</td>
</tr>
<tr>
<td>1</td>
<td>14%</td>
</tr>
<tr>
<td>2</td>
<td>36%</td>
</tr>
<tr>
<td>3</td>
<td>38%</td>
</tr>
<tr>
<td>1-year all cause mortality</td>
<td>8%</td>
</tr>
</tbody>
</table>
Results: agreement between operators and core lab (n=1375)

Agreement between operators and corelab (%)

- TIMI pre-PCI: kappa 0.81, 72.0%
- TIMI post-PCI: kappa 0.62, 85.7%
- MBG: kappa 0.47, 50.0%

Agreement levels:
- >1 Grade
- 1 Grade
- Agreement
Results: prognostic value of TIMI flow and MBG scored by operator

<table>
<thead>
<tr>
<th></th>
<th>TIMI flow grade pre-PCI</th>
<th>TIMI flow grade post-PCI</th>
<th>Myocardial blush grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>9.1</td>
<td>46.3</td>
<td>24.0</td>
</tr>
<tr>
<td>1</td>
<td>10.3</td>
<td>25.0</td>
<td>9.7</td>
</tr>
<tr>
<td>2</td>
<td>6.2</td>
<td>8.4</td>
<td>5.8</td>
</tr>
<tr>
<td>3</td>
<td>4.1</td>
<td>6.6</td>
<td>4.3</td>
</tr>
</tbody>
</table>

p-value

- TIMI flow grade pre-PCI: 0.006
- TIMI flow grade post-PCI: <0.001
- Myocardial blush grade: <0.001
Results: prognostic value of MBG in TIMI flow 3 post-PCI (n=1763)

Myocardial blush grade

1-year all cause mortality (%)

- 0: 16.7%
- 1: 9.8%
- 2: 6.4%
- 3: 4.4%

p<0.001

21†/126
19†/193
41†/644
35†/800
Results: survival per MBG in TIMI flow 3 post-PCI (n=1763)

MBG 3 (35†/800)
MBG 2 (41†/644)
MBG 1 (19†/193)
MBG 0 (21†/126)
## Results: multivariable analysis

<table>
<thead>
<tr>
<th></th>
<th>Univariable analysis</th>
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<th>Multivariable analysis</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Odds ratio (95%CI)</td>
<td><em>P</em></td>
<td>Odds ratio (95%CI)</td>
<td><em>P</em></td>
<td>Odds ratio (95%CI)</td>
<td><em>P</em></td>
</tr>
<tr>
<td>Age, y</td>
<td>1.05 (1.04-1.07)</td>
<td>&lt;0.001</td>
<td>1.05 (1.03-1.06)</td>
<td>&lt;0.001</td>
<td>1.05 (1.03-1.06)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Anterior infarction</td>
<td>1.46 (1.07-2.01)</td>
<td>0.018</td>
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<tr>
<td>Creatinine Kinase peak &gt;1500U/L</td>
<td>1.69 (1.21-2.36)</td>
<td>0.002</td>
<td>1.53 (1.07-2.18)</td>
<td>0.020</td>
<td></td>
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<tr>
<td>TIMI pre-PCI 0 or 1</td>
<td>1.90 (1.30-2.80)</td>
<td>0.001</td>
<td></td>
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<tr>
<td>TIMI post-PCI &lt;3</td>
<td>2.43 (1.71-3.44)</td>
<td>&lt;0.001</td>
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<tr>
<td>MBG 0 or 1</td>
<td>3.71 (2.69-5.12)</td>
<td>&lt;0.001</td>
<td>2.75 (1.95-3.86)</td>
<td>&lt;0.001</td>
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Conclusions and discussion

- MBG scored by the operator during primary PCI is an independent predictor of long-term mortality in patients with STEMI and should be documented in routine clinical practice.

- Despite restored epicardial blood flow, MBGs are strongly related to outcome.

- There is modest interobserver agreement. Online quantitative MBG scoring during PCI seems a promising approach.
Thank you for your attention

University Medical Center Groningen, The Netherlands

M.A. Kampinga
M.W.N. Nijsten
Y.L. Gu
W.A. Dijk
B.J.G.L. de Smet
A.F.M. van den Heuvel
E.S. Tan
F. Zijlstra
MBG angiogram

- Choose angle with best view of myocardial region of interest without overlap of other non-infarct-related regions (RAO 30)

- Record angiographic run:
  - After i.c. nitroglycerin
  - While breath holding of the patient after inspiration
  - Until contrast washout into venous system

- Compare contrast density of the myocardium to noninfarct-related regions
Quantitative MBG scoring

- Mark the infarct-related area on the uploaded run
- Difference in contrast density is computed with correction for panning and background structures